

Office of Environmental Management – Grand Junction



Moab UMTRA Project
Ground Water and Surface Water Monitoring
Report January through June 2016

Revision 0

October 2016



U.S. Department
of Energy

Office of Environmental Management

**Moab UMTRA Project
Ground Water and Surface Water Monitoring Report
January through June 2016**

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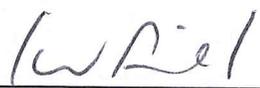
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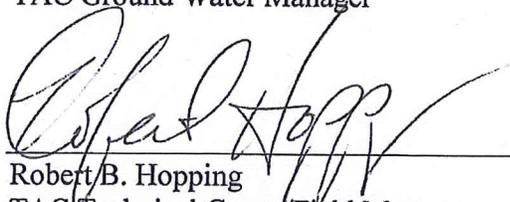
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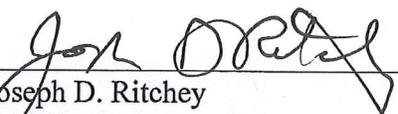
Revision 0

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Acronyms and Abbreviations

bgs	below ground surface
CCB	continuing calibration blank
CCV	continuing calibration verification
CF	Configuration
CFR	Code of Federal Regulations
cfs	cubic feet per second
COC	chain-of-custody
CRI	reporting limit verification
DOE	U.S. Department of Energy
EB	equipment blank
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ft	feet or foot
ICB	initial calibration blank
ICP	inductively coupled plasma
ICV	initial calibration verification
IDL	instrument detection limit
LCS	laboratory control sample
LCSD	laboratory control sample duplicates
MB	method blank
MDL	method detection limit
mg/L	milligrams per liter
ml	milliliters
MS	matrix spike or mass spectrometry
MSD	matrix spike duplicate
QC	quality control
r^2	correlation coefficient
RIN	report identification number
RL	reporting limit
RPD	relative percent difference
SD	serial dilution
SDG	sample data group
UMTRA	Uranium Mill Tailings Remedial Action

1.0 Introduction

1.1 Purpose

The purpose of this semi-annual report is to summarize the results associated with ground water and surface water samples collected from the U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project sites during the first half of 2016. The results of the data validation process are also presented.

Five sampling events were completed during this time frame. The first event was completed in February 2016 in which ground water samples were collected from Configuration (CF) 4 monitoring wells and locations adjacent to the tree plot area in the vicinity of CF3 (Figure 1). These samples were collected to determine the effectiveness of the freshwater injection system into CF4 wells by measuring the contaminant concentrations in monitoring wells upgradient and downgradient of the CF4 injection wells. Samples were also collected from the ground water monitoring wells adjacent to the tree plot area in an attempt to measure the impact of phytoremediation on the ammonia ground water plume.

The second sampling event included the collection of a ground water sample from Crescent Junction well 0205 and a soil sample of the tailings place in the disposal cell in February 2016. This ground water sample was collected as part of the quarterly monitoring for the first quarter of 2016. The soil sample was collected to conduct a soil leach test as an attempt to determine the source of water present in Crescent Junction monitoring well 0205. The location of well 0205 is shown on Figure 2.

The third event was associated with the Crescent Junction quarterly monitoring for the second quarter of 2016. In April 2016 another sample was collected from well 0205 to compare to the previous results.

Another round of ground water samples was collected from the CF4 monitoring wells and locations adjacent to the tree plot area in the vicinity of CF3 in May 2016 during the fourth event, and the fifth and final event was started in June and completed in July 2016. Samples were collected from a variety of site-wide ground water and surface water locations during this site-wide event, with ground water and surface water sampling locations shown on Figures 3 and 4, respectively. Site-wide ground water sampling was conducted to assess any changes and trends in water quality. The surface water samples associated with this event were collected to assess surface water quality adjacent to the site compared to the upstream and downstream water quality.

1.2 Scope

This document presents the Summary of Sampling Events and Data Assessments, including a summary of the anomalous data generated by the validation process, and results for these events. Sampling and analyses were conducted in accordance with the *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830). All data validation follows the criteria according to the *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855).



Figure 1. February and May 2016 CF4 and Tree Plot Area Ground Water Sampling Locations



Figure 2. February and April 2016 Crescent Junction Sampling Location

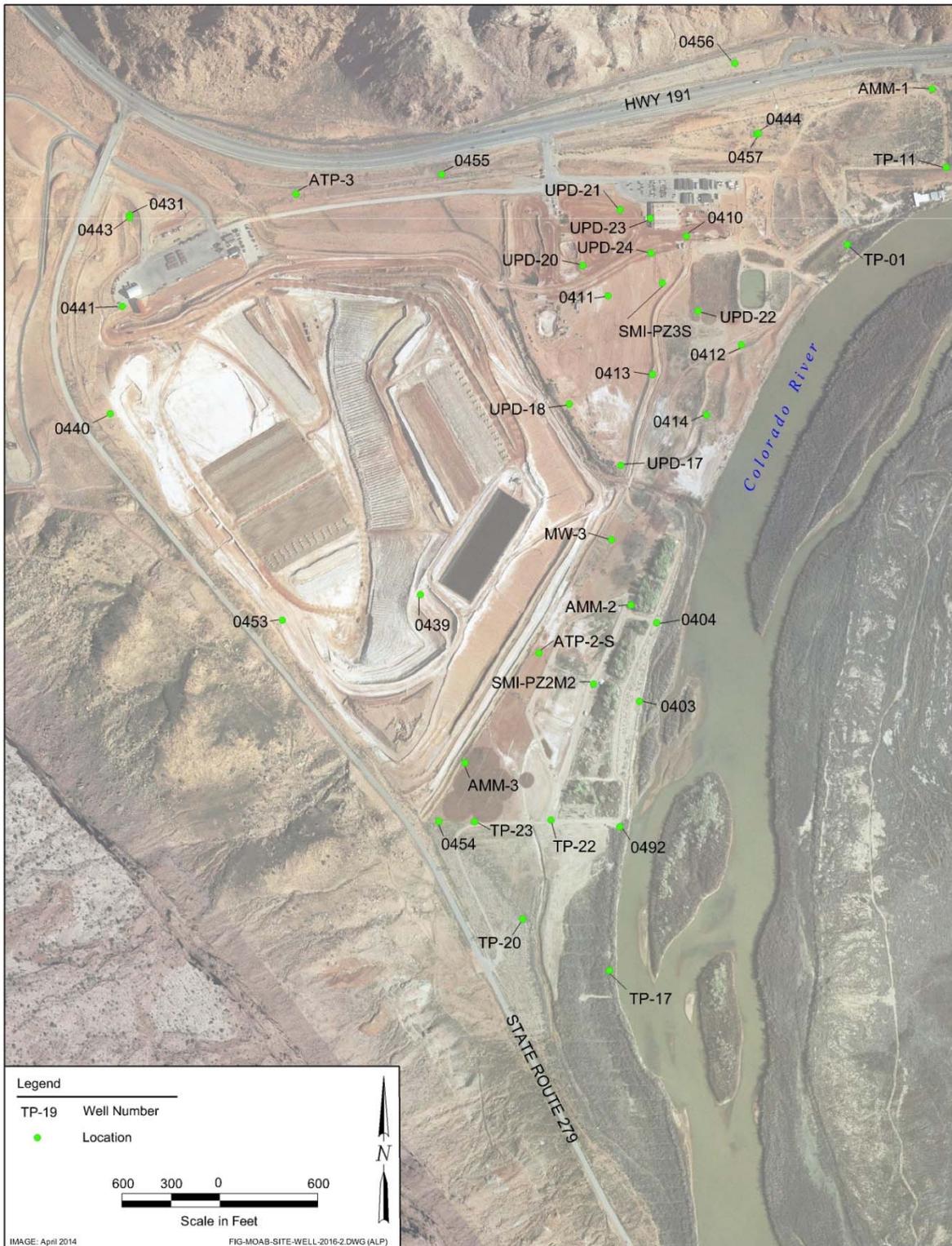


Figure 3. June/July 2016 Site-wide Ground Water Sampling Locations

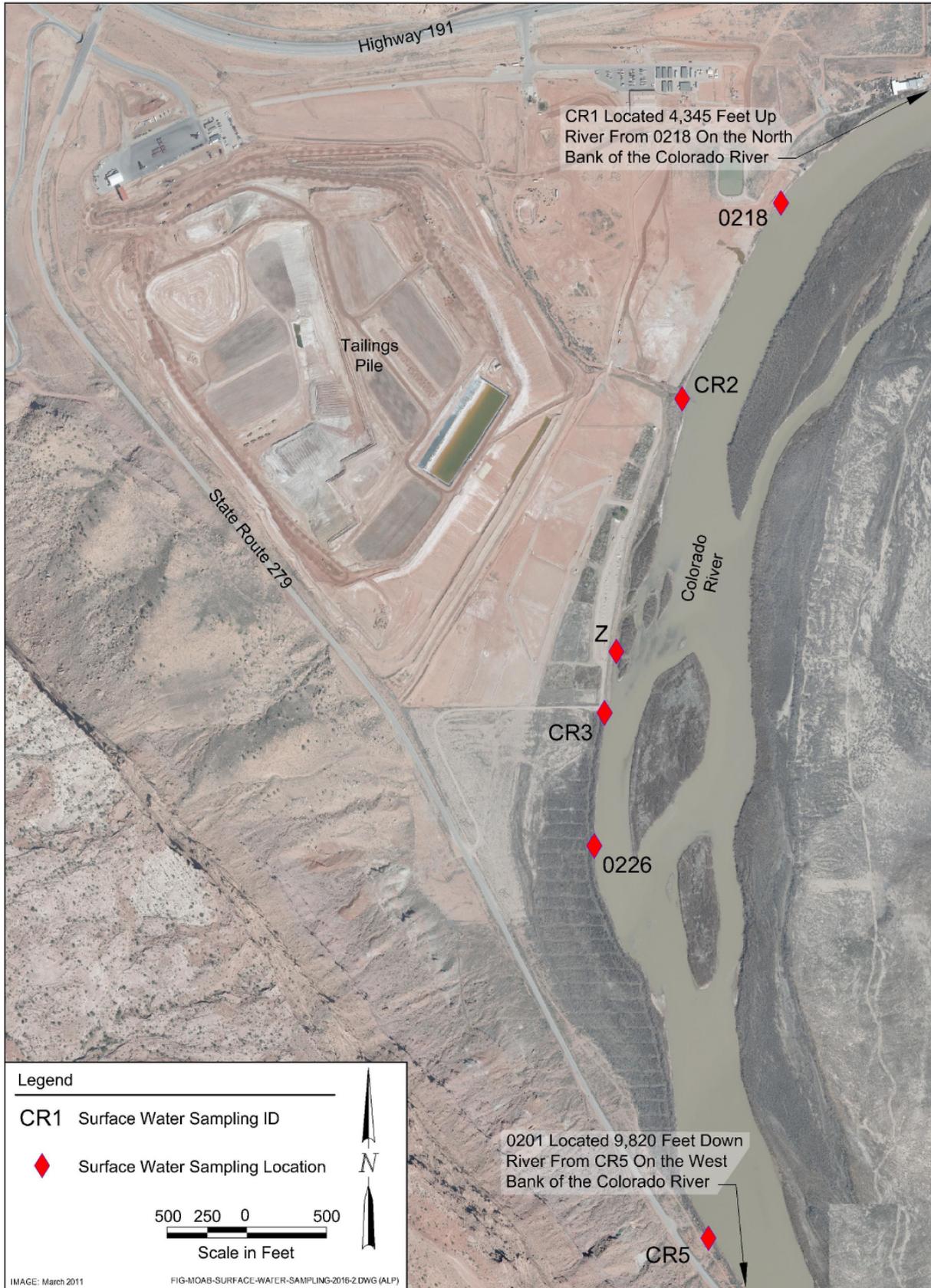


Figure 4. June/July 2016 Surface Water Sampling Locations

Appendix A includes Water Sampling Field Activities Verification, Minimums and Maximums Report, Water Quality Data, Water Level Data, and the trip report associated with the February 2016 CF4 and Tree Plot sampling event. Appendices B and C contain the Water Sampling Field Activities Verifications, Water Quality Data, Water Level Data, and the trip reports associated with the February 2016 and April 2016 Crescent Junction sampling events, respectively.

The Water Sampling Field Activities Verification, Minimums and Maximums Report, Water Quality Data, Water Level Data, and the trip report for the May 2016 CF4 and Tree Plot sampling events are contained in Appendix D. Appendix E includes the Water Sampling Field Activities Verification, Minimums and Maximums Report, Water Quality Data, Trip Blank Report, Water Level Data, and the trip report associated with the June/July 2016 Site-wide sampling event.

All Colorado River flow discussed in this document is measured from the U.S. Geological Survey Cisco gaging station number 09180500. River elevation data were collected adjacent to the site.

The Minimums and Maximums Reports were generated (by the Sample Management System and the SEEPro database) to determine if the applicable data are within a normal statistical range. The new data set was compared to the historical data to determine if these data fall outside the historical data range. The results are not considered anomalous if: (1) identified low concentrations are the result of low detection limits, (2) the concentration detected is less or more than 50 percent of historical minimum or maximum values, or (3) there were fewer than five historical samples for comparison.

2.0 Summary of Sampling Events

2.1 February 2016 CF4 and Tree Plot Sampling Event

Ground water samples were collected from eight CF4 monitoring wells to determine how effectively the freshwater injection system was diluting the ammonia concentrations, particularly downgradient of the CF4 injection wells. Six ground water samples in the vicinity of the tree plot area (near CF3) were collected to determine if phytoremediation had impacted ammonia concentrations.

2.2 February 2016 Crescent Junction Sampling Event

A Ground water sample was collected from well 0205 as part of the quarterly monitoring at the Crescent Junction site. If water is present in any of the four monitoring wells during a quarterly monitoring event, then a sample is collected. In addition, in an attempt to determine the source of this water, a soil sample was collected to conduct a soil leach test.

2.3 April 2016 Crescent Junction Sampling Event

Another sample of the water contained in well 0205 was collected during this event as part of the second quarter 2016 monitoring at the Crescent Junction site.

2.4 May 2016 CF4 and Tree Plot Sampling Event

The same locations sampled in February 2016 in CF4 and in the vicinity of the tree plot area were sampled again in May 2016.

2.5 June/July 2016 Site-wide Sampling Event

Forty-four ground water and surface water samples were collected as part of the site-wide event. This event corresponds to the time frame when the Colorado River is generally experiencing peak spring runoff flow conditions. The 36 ground water samples were collected from a variety of downgradient and cross-gradient locations at various depths. The locations in the vicinity of the northeastern uranium plume were also included. All samples were submitted to ALS laboratory for ammonia and uranium analysis.

The eight surface water samples were collected upstream, downstream, and adjacent to the site during this event.

3.0 Data Assessment

3.1 February 2016 CF4 and Tree Plot Sampling Event

3.1.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

Report Identification Number (RIN) 1602082
Laboratory: ALS, Fort Collins, Colorado
Sample Data Group (SDG) Numbers: 1602219
Analysis: Metals and Inorganics
Validator: Elizabeth Moran
Review Date: 15 August 2016

The samples were prepared and analyzed using accepted procedures as shown in Table 1.

Table 1. February 2016 CF4 and Tree Plot Sampling Event, Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH ₃ -N	EPA 350.1	EPA 350.1
Uranium	SW-846- 3005A	SW-846 6020A

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to Table 3 for an explanation of the data qualifiers applied.

Table 2. February 2016 CF4 and Tree Plot Sampling Event, Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1602219-1 through -16	All in SDG 1602219	Uranium	J	MS-1
1602219-1 through -16	All in SDG 1602219	Ammonia as N	J	MS-1

"J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Table 3. February 2016 CF4 and Tree Plot Sampling Event, Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MS-1	J	U	Per method requirements, a matrix QC was performed for this analysis, however, a sample from this order number was not the selected QC sample. Therefore, the data was not included in the narrative.

QC = quality control

"J" indicates results are estimated; it becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving

ALS laboratory in Fort Collins, Colorado, received a total of 16 samples for RIN 1602082 in one shipment of one cooler. SDG 1602219 consisted of 16 uranium and 16 ammonia samples arrived on February 17, 2016 (UPS tracking number 1Z5W1Y510191340405). The SDG was accompanied by a chain-of-custody (COC) form. The COC form was checked to confirm all samples were listed on the form with sample collection dates and times and that signatures and dates were present, indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times

SDG 1602219, packed in one cooler, was received intact with a temperature of 0.4°C, which complies with all requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates whether the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure the instrument continues to be capable of producing acceptable qualitative and quantitative data.

All laboratory instrument calibrations were performed correctly in accordance with the cited methods. Calibration standards were prepared from independent sources. In addition, for inductively coupled plasma (ICP) analytes (uranium), reporting limit verifications (CRIs) verify the linearity of the calibration curve near the reporting limit (RL). For ICP-mass spectrometry (MS) analytes (uranium), instrument tuning and performance criteria are checked for mass calibration and resolution verifications. ICP-MS analyte uranium internal standards are also analyzed to indicate stability of the instruments.

Method SW-846 6020A, Uranium

The calibrations for the uranium analyses for SDG 1602219 were performed on February 25 and 26, 2016. The initial calibrations were both performed using three calibration standards and three blanks, resulting in calibration curves with correlation coefficient (r^2) values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than three times the instrument detection limit (IDL).

Initial calibration verification (ICV) and continuing calibration verification (CCV) checks were made at the required frequency. All calibration checks met the acceptance criteria. CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL. The CRIs were within the acceptance criteria range for all SDGs. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method EPA 350.1, Ammonia as N

Initial calibrations for ammonia as N for SDG 1602219 were performed using two calibration standards and two blanks on February 25, 2016. The calibration curve had an r^2 value greater than 0.995 and an intercept less than three times the method detection limit (MDL). ICV and CCV checks were made at the required frequency. All calibration check results for the SDG were within the acceptance criteria.

Method and Calibration Blanks

Method blanks (MBs) are analyzed to assess any contamination that may have occurred during sample preparation. Both initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) are analyzed to assess instrument contamination prior to and during sample analysis. All of the uranium CCBs were less than the IDL. No results had to be qualified.

Five ammonia CCBs had results greater than the ammonia MDL. Four of the associated ammonia results were less than five times the highest blank value; however, these sample results were all at or lower than the reporting limit (0.1 milligrams per liter [mg/L]), so none of the data needed to be qualified.

Equipment Blanks

An equipment blank (EB) is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment. One EB should be prepared with each preparation batch. No EBs were collected during this sampling event. All samples were collected using dedicated equipment.

MS Analysis

MS samples were prepared and analyzed for all analytes as a measure of method performance in the sample matrix. Laboratory spike standards are prepared from independent sources. The spike recoveries met the recovery and precision criteria for all analytes. Per method requirements, a matrix quality control (QC) was performed for this analysis. Since a sample from this order number was not selected quality control sample, the matrix QC results were not included in the report; therefore, the ammonia and uranium data was flagged J for reason MS-1.

Laboratory Replicate Analysis

The laboratory replicate analysis data was not included in the narratives since the MS sample was from another client.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory replicates, which only measure laboratory performance. A duplicate sample was collected from location SMI-PZ1S (1602219-16). The duplicate results met the U.S. Environmental Protection Agency (EPA) recommended laboratory duplicate criteria of less than 20 relative percent difference (RPD) for results that are greater than five times the RL.

Laboratory Control Sample

Laboratory control samples (LCSs) provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for ammonia analyses.

LCSs were not reported for uranium. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

Metals Serial Dilution

No serial dilution (SD) data was included with the uranium sample data, since the MS/dilution for this sample batch was from another client. This data was flagged MS-1 for this reason.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable Files

The Electronic Data Deliverable (EDD) files arrived on February 29, 2016. The contents of the EDD were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package

3.1.2 Minimums and Maximums Report and Anomalous Data Review

The Minimums and Maximums Report for this sampling event is located in Appendix A. Based on the results, there were two anomalous data points. One data point was associated with a sample collected from well 0782, in which the ammonia concentration was lower than the historic minimum, and the other associated with the sample collected from location 0787, where the uranium concentration was higher than the historic maximum. Table 4 presents a summary of the results of the Minimums and Maximums Report for this event.

Table 4. Anomalous Data Associated with the February 2016 CF4 and Tree Plot Sampling Event

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Minimum (mg/L)	Historical Maximum (mg/L)	Disposition
0782	2/2/2016	Ammonia Total as N	0.1	0.9	2300	Concentration impacted by freshwater injection system.
0787	2/2/2016	Uranium	2.0	0.022	0.91	Concentration increase may be the result of fresh water mobilizing uranium, will continue monitoring.

3.2 February 2016 Crescent Junction Sampling Event

3.2.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 2, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN: 1602083
 Laboratory: ALS, Fort Collins, Colorado
 SDG Numbers: 1602155, 1602179, 1603207
 Analysis: Metals, Inorganics, Organic Carbon
 Validator: Elizabeth Moran
 Review Date: 1 September 2016

The samples were prepared and analyzed using accepted procedures as shown in Table 5.

Table 5. February 2016 Crescent Junction Sampling Event Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH ₃ -N	EPA 350.1	EPA 350.1
Alkalinity	EPA 310.1	EPA 310.1
Bicarbonate	EPA 310.1	EPA 310.1
Carbonate	EPA 310.1	EPA 310.1
Nitrate/Nitrite as N	EPA 353.2	EPA 353.2
Bromide	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Chloride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Fluoride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Sulfate	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Potassium, Selenium, Silver, Sodium	SW-6010B	EPA 6010B
Uranium	SW-846- 3005A	SW-846 6020A
Total Dissolved Solids	EPA 160.1	540 C
Total Organic Carbon	EPA 415.1	EPA 415.1

Analytical results were qualified as listed in Table 6. Refer to Table 7 for an explanation of the data qualifiers applied.

Table 6. February 2016 Crescent Junction Sampling Event Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1602155-1	0205	Cadmium, Copper	J	MB-1
1602155-1	0205	All inorganics, metals	J	MS-1
1602155-1	0205	Total organic carbon	J	MS-2
1603207-1, -2	CJ Tailings 1, CJ Tailings 2	Nitrate/Nitrite, as N		

CJ = Crescent Junction

“J” indicates results are estimated and becomes “UJ” for analytical results lower than the detection limit.

Table 7. February 2016 Crescent Junction Sampling Event Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MB-1	J	U	The sample results are less than 5x the concentration of the method blank.
MS-1	J	U	Per method requirements, matrix QC was performed for this analysis, however, a sample from this order number was not the selected QC sample. Therefore, the data was not included in the narrative.
MS-2	J	U	The analyte concentration in the MS/MSD were higher than the analytical range, therefore accurate quantitation of the MS/MSD recoveries were not possible.

“J” indicates results are estimated and becomes “UJ” for analytical results lower than the detection limit.

Sample Shipping/Receiving

ALS in Fort Collins, Colorado, received a total of three samples for RIN 1602083 in a shipment of two coolers (Table 8). The first shipment (SDG 1602155) contained one ground water sample from Crescent Junction well 0205. The second shipment (SDG 1602179) contained two samples of tailings from the CJ cell. These samples were sent to ALS to be tumbled for one hour per the soil extraction method.

Approximately 4 grams of sample were extracted with 40 milliliters (ml) of water for nitrate/nitrite as N analysis. The third SDG (1603207) was a re-log of SDG 1602179. The tailings samples had been tumbled for 24 hours per the usual soil extraction method. Sample results were reported as nitrate/nitrite as N in water.

Table 8. February 2016 Crescent Junction Sampling Event, Sample Shipping/Receiving

SDG	No. of locations sampled	Date Shipped	Temperature of Cooler	Tracking Number
1602155	1	02/10/16	4.6°C	1Z5W1Y510192849196
1602179	2	02/11/16	5.2°C	1Z5W1Y510193756389
1603207	2	02/11/16	5.2°C	1Z5W1Y510193756389

The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions. It should be noted that SDG 1603207 consisted of samples that had already been shipped from SDG 1602179 sampling event.

Preservation and Holding Times

All of the samples were received in the correct container types and had been preserved correctly for the requested analyses. All of the samples were analyzed within the applicable holding time.

Case Narratives

The case narratives were reviewed, and all detects were found to be within quality-control procedures except for the following.

Method and Calibration Blanks

MBs are analyzed to assess any contamination that may have occurred during sample preparation. Both ICBs and CCBs are analyzed to assess instrument contamination before and during sample analysis.

Some of the ICP metals blanks were slightly higher than the IDL, and the sample results for cadmium and copper are less than five times the MB; therefore, the copper and cadmium results are flagged “J” for reason MB-1.

The method and calibration blanks for ICP-MS metals, inorganics, and organic carbon were all lower than the IDL.

EBs

An EB is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment. One EB should be prepared with each preparation batch.

No EBs were required for RIN 1602083.

MS and Replicate Analysis

MS sample analysis, performed at a frequency of one per 20 samples unless otherwise noted, is a measure of the ability to recover analytes in a particular matrix. Replicate sample analysis consists of matrix spike (MS) duplicate (MSD) samples and field duplicates at a frequency of one per 20 samples per method or procedural requirements. The MS samples that were chosen for the inorganics and metals were from another client.

For the organic carbon sample in SDG 1602155 and the nitrate/nitrite as N sample from SDG 1603207, the MS was performed, however the native concentration was higher than the analytical range and an accurate quantitation of the MS/MSD recovery was not possible. Therefore, all of the inorganic and metals data were flagged J for reason MS-1. The total organic carbon (0205) and nitrate/nitrite as N (CJ Tailings 1) samples were flagged J for reason MS-2.

Laboratory Control Sample

Laboratory control samples (LCSs) provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for all analyses on all three of the SDGs.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable File

The EDD files arrived on February 28 and March 31, 2016. The contents of the EDD were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.2.2 Minimums and Maximums Report and Anomalous Data Review

Because this location has been sampled fewer than five times, a Minimums and Maximums Report for this sampling event was not generated. As a result, there were no anomalous data points associated with this sampling event.

3.3 April 2016 Crescent Junction Sampling Event

3.3.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 2, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN	1604084
Laboratory:	ALS, Fort Collins, Colorado
SDG Number:	1605195
Analysis:	Inorganics and Metals
Validator:	Elizabeth Moran
Review Date:	6 September 2016

The samples were prepared and analyzed using accepted procedures as shown in Table 9. Analytical results were qualified as listed in Table 10. Refer to Table 11 for an explanation of the data qualifiers applied.

Sample Shipping/Receiving

ALS Analytics in Fort Collins, Colorado, received one for RIN 1602084 in a shipment of one cooler. The shipment (SDG 1605195) contained one ground water sample from Crescent Junction well 0205. The temperature of the cooler was 4.2°C and it arrived on May 9, 2016 (Tracking number 1Z5W1Y510195205929). The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times

All of the samples were received in the correct container types and had been preserved correctly for the requested analyses. All of the samples were analyzed within the applicable holding time, with the exception of the TDS, alkalinity, bicarbonate, and carbonate samples, which arrived to the laboratory at the end of the 7-day hold time.

Table 9. April 2016 Crescent Junction Sampling Event Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N, NH ₃ -N	EPA 350.1	Analytical Method
Alkalinity	EPA 310.1	EPA 350.1
Bicarbonate	EPA 310.1	EPA 310.1
Carbonate	EPA 310.1	EPA 310.1
Nitrate/Nitrite as N	EPA 353.2	EPA 310.1
Bromide	EPA 300.0 Rev 2.1	EPA 353.2
Chloride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Fluoride	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Sulfate	EPA 300.0 Rev 2.1	300.0 Rev 2.1
Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Potassium, Selenium, Silver, Sodium	SW-6010B	300.0 Rev 2.1
Uranium	SW-846- 3005A	EPA 6010B
Total Dissolved Solids	EPA 160.1	SW-846 6020A
Alkalinity	EPA 350.1	540 C
Bicarbonate		
Carbonate		

Table 10. April 2016 Crescent Junction Sampling Event Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1605195-1	0205	Chromium, Copper	J	MB-1
1605195-1	0205	TDS	J	MS-1
1605195-1	0205	Ammonia, as N; Nitrate/Nitrite, as N; Bromide; Chloride; Fluoride; Sulfate; all Metals	J	MS-2

“J” indicates results are estimated and becomes “UJ” for analytical results lower than the detection limit.

The COC forms were checked to confirm that all of the samples were listed on the form with sample collection dates and times, and signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions. It should be noted that SDG 1603207 consisted of samples that had already been shipped from SDG 1602179 sampling event.

Case Narratives

The case narratives were reviewed, and all detects were found to be within quality-control procedures except for the following.

Table 11. April 2016 Crescent Junction Sampling Event Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MB-1	J	U	The sample results are less than 5x the concentration of the method blank.
MS-1	J	U	The analyte concentration in the MS/MSD were higher than the analytical range, therefore accurate quantitation of the MS/MSD recoveries were not possible.
MS-2	J	U	Per method requirements, matrix QC was performed for this analysis, however, a sample from this order number was not the selected QC sample. Therefore, the data was not included in the narrative.
SD-1	J	U	Per method requirements, an SD was performed for this analysis; however, a sample from this order number was not the selected QC sample, so the SD data were not included in the narrative.

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Method and Calibration Blanks

MBs are analyzed to assess any contamination that may have occurred during sample preparation. Both ICBs and CCBs are analyzed to assess instrument contamination before and during sample analysis. Some of the ICP metals blanks were slightly higher than the IDL. On SDG 1605195, the chromium and molybdenum results were less than five times the concentration of the method blank; therefore, the chromium and molybdenum data is flagged J for reason MB-1.

EBs

An EB is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment. One EB should be prepared with each preparation batch.

No EBs were required for RIN 1604084.

MS and Replicate Analysis

MS sample analysis, performed at a frequency of one per 20 samples unless otherwise noted, is a measure of the ability to recover analytes in a particular matrix. For SDG 1605195, a MS was performed for the alkalinity, bicarbonate, carbonate, and TDS analyses. The TDS spike failed due to the concentration in the native sample. Therefore, the TDS data is flagged J for reason MS-1.

For the remaining analytes, the selected quality control sample was from another client and not included in the narrative, so the ammonia, nitrate/nitrite as N, bromide, chloride, fluoride, sulfate, and all of the metal analyses are flagged J for reason MS-2.

Laboratory Control Sample

LCSs provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for all analyses on all three of the SDGs.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable File

The EDD files arrived on May 28, 2016. The contents of the EDD were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.3.2 Minimums and Maximums Report and Anomalous Data Review

This sampling event represents the fifth time this location was sampled, with the Minimums and Maximums Report located in Appendix C. Based on the results, there were no anomalous data points associated with this sampling event.

3.4 May 2016 CF4 and Tree Plot Sampling Event

3.4.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN 1605085
Laboratory: ALS, Fort Collins, Colorado
SDG Numbers: 1605193
Analysis: Inorganics and Metals
Validator: Elizabeth Moran
Review Date: 23 August 2016

The samples were prepared and analyzed using accepted procedures as shown in Table 12. Analytical results were qualified as listed in Table 13. Refer to Table 14 for an explanation of the data qualifiers applied.

Table 12. May 2016 CF4 and Tree Plot Sampling Event Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N	EPA 350.1	EPA 350.1
Uranium	SW-846 3005A	SW-846 6020A

Table 13. May 2016 CF4 and Tree Plot Sampling Event Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1605193-1 through -16	All in SDG 1605193	Uranium	J	MS-1
1605193-1 through -16	All in SDG 1605193	Ammonia as N	J	MS-2

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Table 14. May 2016 CF4 and Tree Plot Sampling Event Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
MS-1	J	U	Per method requirements, matrix QC was performed for this analysis, however, a sample from this order number was not the selected QC sample. Therefore, the data was not included in the narrative.
MS-2	J	U	The NH3-N concentration in the native sample was higher than the analytical range; therefore accurate quantitation of the MS/MSD recoveries was not possible.

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Sample Shipping/Receiving

ALS Analytics in Fort Collins, Colorado, received a total of 16 samples for RIN 1605085 in one shipment of one cooler. SDG 1605193 consisted of 16 uranium and 16 ammonia samples arrived on May 10, 2016 (UPS tracking number 1Z5W1Y510195205929). The SDG was accompanied by a COC form.

The COC form was checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions.

Preservation and Holding Times

SDG 1605193, packed in one cooler, was received intact with a temperature of 4.2°C, which complies with all requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve.

Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. Calibration standards were prepared from independent sources.

In addition, for ICP analytes (uranium), CRIs verify the linearity of the calibration curve near the RL. For ICP-MS analytes (uranium), instrument tuning and performance criteria are checked for mass calibration and resolution verifications. And also for ICP-MS analyte uranium, internal standards are analyzed to indicate stability of the instruments.

Method SW-846 6020A, Uranium

The calibration for the uranium analyses for SDG 1605193 was performed on May 18, 2016. The initial calibrations were both performed using three calibration standards and four blanks, resulting in calibration curves with r^2 values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than three times the IDL.

ICV and CCV checks were made at the required frequency. All calibration checks met the acceptance criteria. CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL. The CRI verifications were within the acceptance criteria range for all SDGs. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method EPA 350.1, Ammonia as N

Initial calibrations for ammonia as N for SDG 1605193 were performed using two calibration standards and two blanks on May 18, 2016. The calibration curve had an r^2 value greater than 0.995 and an intercept less than three times the MDL. ICV and CCV checks were made at the required frequency. All calibration check results for the SDG was within the acceptance criteria.

Method and Calibration Blanks

MBs are analyzed to assess any contamination that may have occurred during sample preparation. Both ICBs and CCBs are analyzed to assess instrument contamination prior to and during sample analysis. All of the uranium CCBs were less than the IDL. No results had to be qualified. Three ammonia CCBs had results that were greater than the ammonia MDL. Two of the associated ammonia results were less than five times the highest blank value, however, these sample results were all at or lower than the reporting limit (0.1 mg/L), so none of the data needed to be qualified.

EBs

An EB is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment. One EB should be prepared with each preparation batch. No EBs were collected during this sampling event. All samples were collected using dedicated equipment.

MS Analysis

MS samples were prepared and analyzed for all analytes as a measure of method performance in the sample matrix. Laboratory spike standards are prepared from independent sources. The spike recoveries met the recovery and precision criteria for all analytes. Per method requirements, a matrix QC was performed for the uranium analysis. Since a sample from this order number was not selected quality control sample, the matrix QC results were not included in the report. Therefore, the uranium data was flagged J for reason MS-1.

An MS was performed on sample 1605193-1 (location 0682). The ammonia concentration in this sample was higher than the analytical range, so an accurate quantitation of the MS/MSD recovery was not possible. Therefore, the ammonia data was flagged J for reason MS-2.

Laboratory Replicate Analysis

The laboratory replicate analysis data was not included in the narratives since the MS sample was from another client.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory replicates, which measure only laboratory performance. A duplicate sample was collected from location SMI-PZ1S (1605193-16). The duplicate results met the EPA recommended laboratory duplicate criteria of less than 20 RPD for results that are greater than five times the RL.

Laboratory Control Sample

LCSs provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for ammonia analyses.

LCSs were not reported for uranium. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

Metals SD

No SD data was included with the uranium sample data, since the MS/dilution for this sample batch was from another client. This data was flagged MS-1 for this reason.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable Files

The EDD files arrived on May 28, 2016. The contents of the EDD were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.4.2 Minimums and Maximums Report and Anomalous Data Review

The Minimums and Maximums Report for this sampling event is located in Appendix D. Based on the results, there was one anomalous data point from location 0787 associated with the ammonia concentration higher than the historic maximum. Table 15 presents a summary of the results of the Minimums and Maximums Report for this event.

Table 15. Anomalous Data Associated with the May 2016 CF4 and Tree Plot Sampling Event

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Minimum (mg/L)	Historical Maximum (mg/L)	Disposition
0787	5/3/2016	Ammonia Total as N	2900	21	910	Increasing river stage during this time period tends to increase elevation of the fresh water/brine interface, increasing contaminant concentrations

3.5 June/July 2016 Site-wide Sampling Event

3.5.1 Laboratory Performance Assessment

This validation was performed according to *Standard Practice for Validation of Laboratory Data*. The procedure was applied at Level 3, Data Deliverables Examination. All analyses were successfully completed.

General Information and Validation Results

RIN: 1606086
 Laboratory: ALS, Fort Collins, Colorado
 SDG Numbers: 1606305, 1607132
 Analysis: Inorganics and Metals
 Validator: Elizabeth Moran
 Review Date: 29 August 2016

The samples were prepared and analyzed using accepted procedures as shown in Table 16.

Table 16. June/July 2016 Site-wide Sampling Event Analytes and Methods

Analyte	Preparation Method	Analytical Method
Ammonia as N	EPA 350.1	EPA 350.1
Uranium	SW-846 3005A	SW-846 6020A

Analytical results were qualified as listed in Table 17. Refer to Table 18 for an explanation of the data qualifiers applied.

Sample Shipping/Receiving

ALS Analytics in Fort Collins, Colorado, received a total of 48 samples for RIN 1606086 in two shipments (Table 19).

The two SDGs were accompanied by a COC form. The COC form was checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents, including the COC forms and the sample tickets, had no errors or omissions. It should be noted that in SDG 1607132, sample location CR3 (1607132-16) was mistakenly labeled as SMI-PZ1S. The error was corrected at the laboratory.

Table 17. June/July 2016 Site-wide Sampling Event Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1606305-4, -7, -8, -12, -15, -18	SDG 1506109	Ammonia	J	CCB-1
1607132-1 through -28	All in SDG 1607132	Ammonia	J	MS-1
1606305-1 through -20, 1607132-1 through -28	All in SDGs 1606305 and 1607132	Uranium	J	MS-2, SD-1

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Table 18. June/July 2016 Site-wide Sampling Event Reason Codes for Data Flags

Reason Code	Qualifier (Detects)	Qualifier (Non-detects)	Explanation
SD-1	J	U	No SDs were run during the uranium analysis.
MS-1	J	U	A matrix QC was performed with this analysis, but a sample from this order number was not selected as the QC sample.
MS-2	J	U	An LCSD was used instead of an MS. An MS was conducted with SDG 1607132, but the sample that was chosen is from another client.
CCB-1	J	U	CCBs-2, -3, -4 were higher than the MDL (0.04 mg/L vs 0.03 mg/L), therefore, all detects <5x the highest blank should be flagged.

"J" indicates results are estimated and becomes "UJ" for analytical results lower than the detection limit.

Table 19. June/July 2016 Site-wide Sampling Event, Sample Shipping/Receiving

SDG	Number of Samples	Arrival Date	UPS Tracking Number(s)
1606305	20	06/16/2016	1Z5W1Y510192158076
1606086	28	07/08/2016	1Z5W1Y510196491976

Preservation and Holding Times

SDG 1606305 was received intact with a temperature of 3.8°C, SDG 1607132 was received intact with temperatures of 4.2°C which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve.

Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. Calibration standards were prepared from independent sources.

In addition, for ICP analytes (uranium), CRIs verify the linearity of the calibration curve near the RL. For ICP-MS analytes (uranium), instrument tuning and performance criteria are checked for mass calibration and resolution verifications. And also for ICP-MS analyte uranium, internal standards are analyzed to indicate stability of the instruments.

Method SW-846 6020A, Uranium

The calibrations for the uranium analyses were performed on June 20, June 21, July 13 and July 14, 2016. The initial calibrations were both performed using three calibration standards and four blank, resulting in calibration curves with r^2 values greater than 0.995. The values of the calibration curve intercepts for uranium were positive and less than 3 times the IDL.

ICV and CCV checks were made at the required frequency. All calibration checks met the acceptance criteria. CRIs were made at the required frequency to verify the linearity of the calibration curve near the RL. The CRI verifications were within the acceptance criteria range for all SDGs.

Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries were stable and within acceptable ranges.

Method EPA 350.1, Ammonia as N

Initial calibrations for ammonia as N were performed using four calibration standards and a blank on July 8 and July 7, 2016. The calibration curve had an r^2 value greater than 0.995 and an intercept less than three times the MDL. ICV and CCV checks were made at the required frequency. All calibration check results for all SDGs were within the acceptance criteria.

Method and Calibration Blanks

MBs are analyzed to assess any contamination that may have occurred during sample preparation. Both ICBs and CCBs are analyzed to assess instrument contamination prior to and during sample analysis. Detected sample results associated with blanks results greater than the MDL or IDL (depending on method requirements) were “J” qualified when the detections were less than five times the blank concentration. Non-detects were not qualified.

Uranium SDGs 1606305 had one CCB that was slightly higher than the IDL, however, none of the sample results were <5x the highest CCB, so no data had to be qualified.

Three of the ammonia calibration blanks (CCB-2, -3, -4) on SDG 1606305 had a result that was >5x the detection limit. Three of the sample locations that were less than five times the highest blank were non-detects, so the data did not have to be qualified. One of the sample locations, 1606305-12 (ATP-3), had an ammonia concentration just higher than the 5x the highest blank. Therefore, this location is flagged “U” for reason CCB-1.

On SDG 1607132, six of the ammonia calibration blanks (CCB-2, -3, -4, -6, -7, -8) had a result of 0.032 to 0.053 mg/L and the MDL is 0.03 mg/L. Therefore, all data that is <5x (less than 0.269 mg/L) the maximum blank concentration should be qualified. The only sample results that are less than 0.235 mg/L are those that are at or lower than the detection limit. Therefore, no data was flagged.

EBs

An EB is a sample of analyte-free media collected from a rinse of non-dedicated sampling equipment used to sample surface water. EBs are collected to document adequate decontamination of non-dedicated equipment. One EB should be prepared with each preparation batch.

One equipment blank (location 2002, 1607132-14) was collected after the surface water tubing was decontaminated. The sample results were at or lower than the reporting limit for both ammonia and uranium.

MS Analysis

An MS sample was analyzed with ammonia SDG 1606305. The MS sample result was within the recovery limits. For ammonia SDG 1607132, the MS sample was from another client, so the details were not included in the narrative. Therefore, all of the ammonia samples are flagged J.

MS samples were not conducted for the uranium analysis on both of the SDGs due to a limited sample volume. Instead, laboratory control sample duplicates (LCSDs) were performed. Since a sample from the order number was not the selected quality control sample, all of the uranium data from both SDGs are flagged J.

Laboratory Replicate Analysis

The laboratory replicate results demonstrate acceptable laboratory precision. The RPD values for the reported MSD results for all other analytes should be less than 20 percent for results greater than five times the RL. The RPD for the MSD for ammonia in SDG 1606305 passed the criteria for laboratory precision; however, since there were no MS samples from the uranium samples in SDG 1606305 and in the ammonia and uranium samples for SDG 1607132, a laboratory replicate analysis was not performed.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory replicates, which measure only laboratory performance.

Duplicate samples were collected from locations 0441 (1606305-8), SMI-PZ3S (1607132-13), and 0412 (1607132-14). The duplicate results met the EPA-recommended laboratory duplicate criteria of less than 20 RPD for results that are greater than five times the RL.

LCSs

LCSs provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. LCS results were acceptable for ammonia analyses.

LCSs were not reported for uranium. Per national environmental laboratory accreditation requirements provided by the NELAC Institute, an MS may be used in place of an LCS provided the acceptance criteria are as stringent.

Metals SD

SD samples are prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Since no MS samples were run on the uranium samples, there were no SD samples. The uranium samples are flagged "J" for reason SD-1.

Detection Limits/Dilutions

Dilutions were prepared in a consistent and acceptable manner when dilutions were required. The required detection limits were achieved for all analytes.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

EDD Files

The EDD files arrived on July 19 and July 28. The contents of the EDD files were manually examined to ensure all and only the requested data were delivered in compliance with requirements and that the sample results accurately reflected the data contained in the sample data package.

3.5.2 Minimums and Maximums Report and Anomalous Data Review

The Minimums and Maximums Report for this sampling event is located in Appendix E. Based on the results, there was one anomalous data point from location UPD-22 associated with the ammonia concentration higher than the historic maximum. Table 20 presents a summary of the results of the Minimums and Maximums Report for this event.

Table 20. Anomalous Data Associated with the June/July 2016 Site-wide Sampling Event

Location	Sample Date	Analyte	Concentration (mg/L)	Historical Minimum (mg/L)	Historical Maximum (mg/L)	Disposition
UPD-22	6/3/2016	Ammonia Total as N	7.1	0.76	4.4	Concentration has been gradually increasing since June 2004; will continue monitoring.

4.0 Results

4.1 February 2016 CF4 and Tree Plot Sampling Event Results

The observation wells surrounding the CF4 injection wells (Figure 1) were sampled in February 2016 to evaluate the effectiveness of the freshwater injection system. These injection wells are screened and, therefore, deliver freshwater into the subsurface from 15 to 35 foot below ground surface (ft bgs).

The ammonia concentrations are displayed on Figure 5. The results show a significant reduction in concentrations in the downgradient (east) direction, particularly in the zone higher than 35 ft bgs. In the upgradient direction, the ground water system down to a depth of 35 ft bgs is also impacted by freshwater injection.

The highest ammonia concentration was associated with the sample collected from well 0781 from a depth of 48 ft bgs upgradient of the CF4 injection wells.

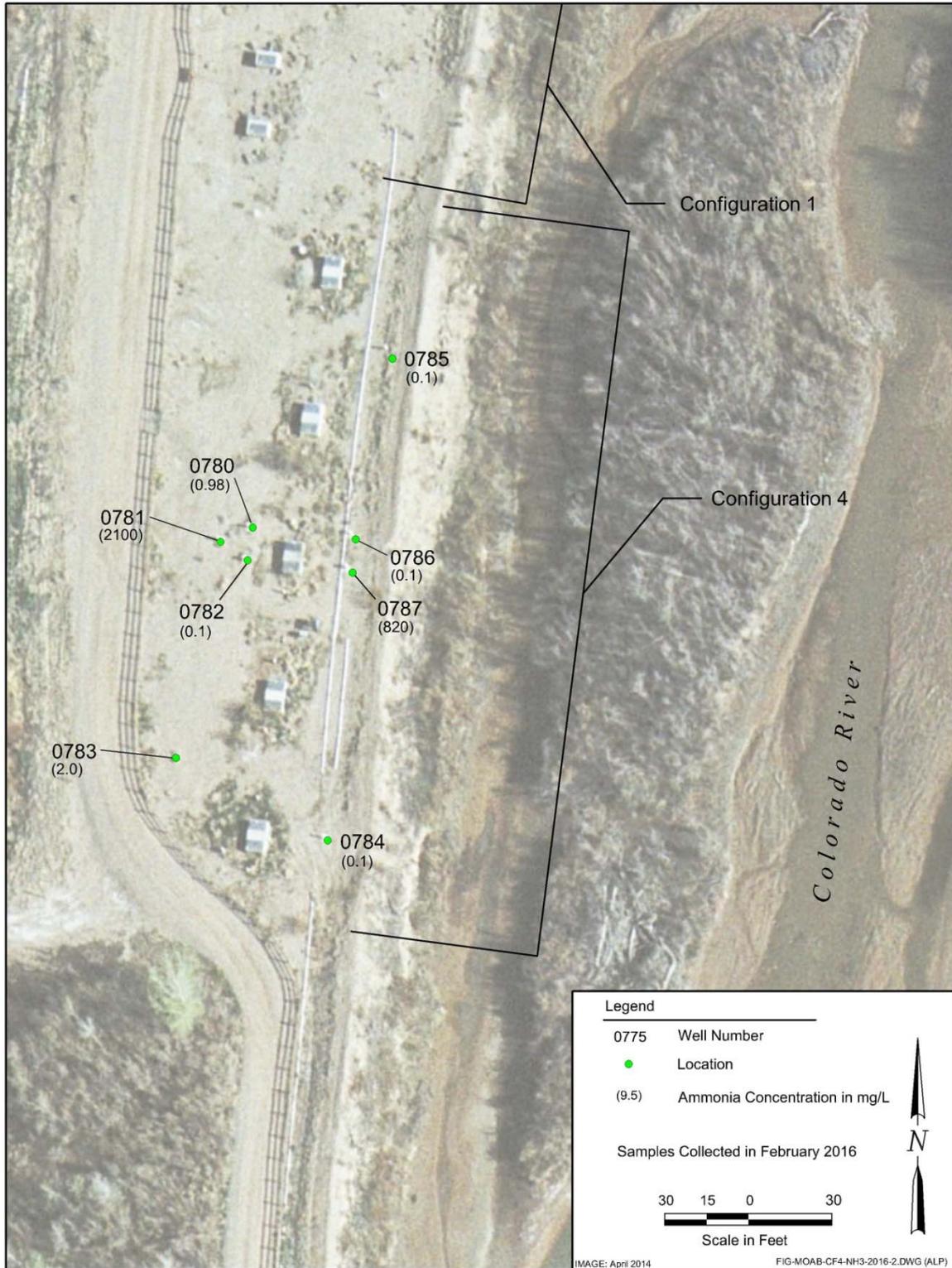


Figure 5. February 2016 CF4 Ground Water Ammonia Concentrations

Figure 6 presents the ground water mound developed as a result of the freshwater injection system on November 2, the same time the samples were collected. The ground water elevation data indicate there was a difference of more than 10 feet (ft) between the elevation inside the injection wells and surrounding observation wells.

In an attempt to determine if the revegetation tree plots through phytoremediation reduces the ammonia concentrations in ground water, samples were collected from wells 0682, 0683 (both have a sample depth of 28 ft bgs), 0684, 0732, and 0733 (sample depth of 18 ft bgs) on February 11 and 12. These locations are just downgradient of the tree plot in the vicinity of CF3 (Figure 1). Water chemistry data from well AMM-2 (sample depth of 48 ft bgs, collected on October 21) were also useful because it is located just upgradient of the tree plot area.

The influence of phytoremediation on the ground water system still remains difficult to determine because of the other hydrogeologic impacts to this area. Flood irrigation has taken place inside the tree plot since 2005/2006 and upgradient to the tree plot since 2010 (when the CF5 well field was installed).

Ground water extraction from CF5 (in particular, well 0813, which is located approximately 50 ft upgradient of the tree plot) also plays a role. In addition, this area is in close proximity to the riverbank and the Moab Wash. Previous investigations have shown that ground water underlying this area is impacted by a freshwater lens that develops when the spring runoff river stage is higher than average, further reducing the ammonia concentrations. The ammonia concentrations will be discussed in Section 4.4 along with the data collected from these tree plot locations in May 2016.

4.2 February 2016 Crescent Junction Sampling Event Results

Table 21 displays the analytical results of the four samples collected from well 0205. The analyte concentrations of the samples collected from well 0205 have generally not significantly changed since the second sample was collected in July 2015.

On March 1, 2016, 40 ml of de-ionized water was tumbled through 4 grams of two tailings samples from the Crescent Junction disposal cell for 1 hour. The water was then filtered and analyzed for nitrate/nitrite as N and the concentrations were 110 and 115 mg/L. On March 29, 2016, 40 ml of de-ionized water was tumbled through 4 grams of the same tailings samples from the March 1, 2016 test. This time, the water was tumbled through the tailings samples for 24 hours. The resulting nitrate/nitrite as N concentrations in the filtered water were 110 and 120 mg/L.

The lead chemist for ALS noted that the ratio of soil to water used in the tumble (4 grams to 40 ml) was far higher than the amount of water that would be present in soils. A soil with a 50 percent saturation value (4 grams of soil have 2 grams of water) has, effectively, a 20-times-higher concentration that would be reflected in a result generated by the tumbling. So, the results are essentially a dilution of what would be expected in the actual ground water.

All analytical data associated with this Crescent Junction sampling event are provided in Appendix A.

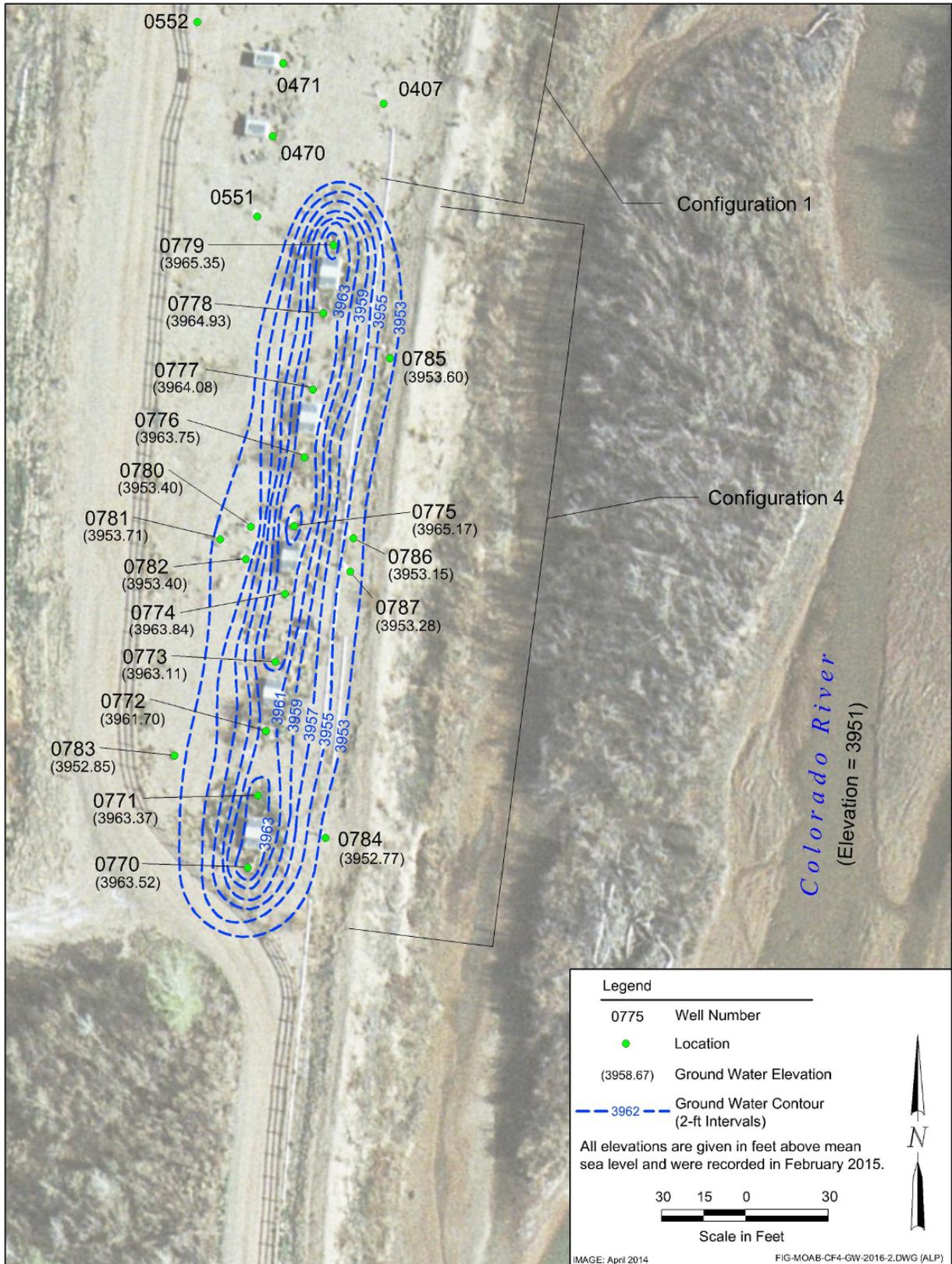


Figure 6. February 2016 CF4 Ground Water Elevation Contour Map during Injection

Table 21. Crescent Junction Well 0205 Analyte and Leachate Batch Test Concentrations

Analyte	Analyte Concentration in Well 0205 on 7/15/15 (mg/L)	Analyte Concentration in Well 0205 on 7/29/15 (mg/L)	Analyte Concentration in Well 0205 on 11/4/15 (mg/L)	Analyte Concentration in Well 0205 on 2/10/16 (mg/L)	Leachate Batch Test-CJ Tailings (mg/L)
Ammonia as N	16	17	18	16	N/A
Arsenic	0.039 ²	0.039 ²	0.039 ²	0.039 ²	N/A
Barium	0.027	0.019	0.024	0.014	N/A
Boron	1.6	1.3	1.4	1.1	N/A
Bromide	18	20 ²	20 ²	10 ²	N/A
Cadmium	0.003 ²	0.003 ²	0.003 ²	0.0003 ²	N/A
Calcium	280	400	380	270	N/A
Chloride	5,200	2,000	3,700	3,300	N/A
Chromium	0.0051 ²	0.021	0.005	0.017	N/A
Copper	0.0097 ²	0.017	0.021	0.0034	N/A
Fluoride	5 ²	10 ²	10 ²	5 ²	N/A
Iron	0.06	0.083	0.049	0.0095	N/A
Lead	0.013 ²	0.013 ²	0.016	0.0013 ²	N/A
Magnesium	370	1,100	1,000	1,000	N/A
Manganese	0.45	0.71	0.570	0.35	N/A
Molybdenum	0.054	0.022	0.011 ²	0.019	N/A
Nitrate/Nitrite as N	710	1,100	970	920	N/A
Nitrate as N	N/A	N/A	N/A	990	100/115
Nitrite as N	N/A	N/A	N/A	5 ²	N/A
Potassium	57	59	57	64	N/A
Selenium	4.6	5.4	4.8	4.9	N/A
Sodium	12,000	11,000	9,900	9,600	N/A
Sulfate	20,000	20,000	21,000	21,000	N/A
Total Dissolved Solids	N/A	43,000	48,000	40,000	N/A
Total Organic Carbon	N/A	N/A	N/A	15	N/A
Uranium	0.017	0.000029 ²	0.025	0.033	N/A

1 = Concentration of Nitrate/Nitrite as N in sample collected from same location on 10/21/2015 was also 17 mg/L

2 = At or lower than detection limit

N/A = Not Applicable, sample not analyzed for this analyte

4.3 April 2016 Crescent Junction Sampling Event Results

In April, another sample was collected from well 0205 as part of the second quarter 2016 Crescent Junction monitoring event. Table 22 provides a summary of the analytical results of the five samples collected from well 0205 since July 2015. As shown in Table 22, the analyte concentrations have not significantly changed since late July 2016.

4.4 May 2016 CF4 and Tree Plot Sampling Event Results

The observation wells surrounding the CF4 injection wells (Figure 3) were sampled in early November 2015 to evaluate the effectiveness of the freshwater injection system. These injection wells are screened and, therefore, deliver freshwater into the subsurface from 15 to 35 ft bgs.

Table 22. Crescent Junction Well 0205 Analyte Concentrations, July 2015 through April 2016

Analyte	Analyte Concentration in Well 0205 on 7/15/15 (mg/L)	Analyte Concentration in Well 0205 on 7/29/15 (mg/L)	Analyte Concentration in Well 0205 on 11/4/15 (mg/L)	Analyte Concentration in Well 0205 on 2/10/16 (mg/L)	Analyte Concentration in Well 0205 on 4/26/16 (mg/L)
Ammonia as N	16	17	18	16	13
Arsenic	0.039 ²				
Barium	0.027	0.019	0.024	0.014	0.012
Bicarbonate as CaCO ₃	N/A	N/A	N/A	N/A	990
Boron	1.6	1.3	1.4	1.1	1.3
Bromide	18	20 ²	20 ²	10 ²	20 ²
Cadmium	0.003 ²	0.003 ²	0.003 ²	0.0003 ²	0.0033 ²
Calcium	280	400	380	270	350
Chloride	5,200	2,000	3,700	3,300	3,400
Carbonate as CaCO ₃	N/A	N/A	N/A	N/A	20
Chromium	0.0051 ²	0.021	0.005	0.017	0.0051 ²
Copper	0.0097 ²	0.017	0.021	0.0034	0.0097 ²
Fluoride	5 ²	10 ²	10 ²	5 ²	10 ²
Iron	0.06	0.083	0.049	0.0095	0.049 ²
Lead	0.013 ²	0.013 ²	0.016	0.0013 ²	0.0013 ²
Magnesium	370	1,100	1,000	1,000	1,000
Manganese	0.45	0.71	0.570	0.35	0.47
Molybdenum	0.054	0.022	0.011 ²	0.019	0.011 ²
Nitrate/Nitrite as N	710	1,100	970	920	930
Nitrate as N	N/A	N/A	N/A	990	N/A
Nitrite as N	N/A	N/A	N/A	5 ²	N/A
Potassium	57	59	57	64	53
Selenium	4.6	5.4	4.8	4.9	4.4
Sodium	12,000	11,000	9,900	9,600	10,000
Sulfate	20,000	20,000	21,000	21,000	21,000
Total Alkalinity as CaCO ₃	N/A	N/A	N/A	N/A	990
Total Dissolved Solids	N/A	43,000	48,000	40,000	24,000
Total Organic Carbon	N/A	N/A	N/A	15	N/A
Uranium	0.017	0.000029 ²	0.025	0.033	0.033

1 = Concentration of Nitrate/Nitrite as N in sample collected from same location on 10/21/2015 was also 17 mg/L

2 = At or lower than detection limit

N/A = Not Applicable, sample not analyzed for this analyte

The ammonia concentrations are displayed on Figure 7. As discussed in Section 4.1, the results show a significant reduction in concentrations in the downgradient (east) direction, particularly in the zone higher than 35 ft bgs. Again, the highest ammonia concentration was associated with the sample collected from well 0781 from a depth of 48 ft bgs upgradient of the CF4 injection wells.

Figure 8 presents the ground water mound developed as a result of the freshwater injection system in May, the same time the samples were collected. The ground water elevation data indicate there was a difference of more than 12 ft between the elevation inside the injection wells and surrounding observation wells, with the difference between the mounding observed in February being the higher ground water surface elevation due to the spring runoff river flows.

During this sampling event additional samples were also collected from the locations in the vicinity of the tree plot. All well locations and samples depths are presented in Section 4.1.

Figure 9 presents the ammonia concentrations measured since 2005 from wells located upgradient and downgradient of the tree plot. The concentration data are plotted with the river stage over this same time period. Typically, this area is subjected to flood irrigation between April and September.

With the limited data from these wells since 2009 (no sampling occurred due to site extraction and injection operations taking place in other areas of the well field), it is difficult to quantify the impacts of phytoremediation at this time.

Subsequent and more frequent sampling of these locations has been scheduled. In addition, pressure transducers were installed in this area of the site to determine if the ground water surface elevation is impacted by plant transpiration during the spring through the fall.

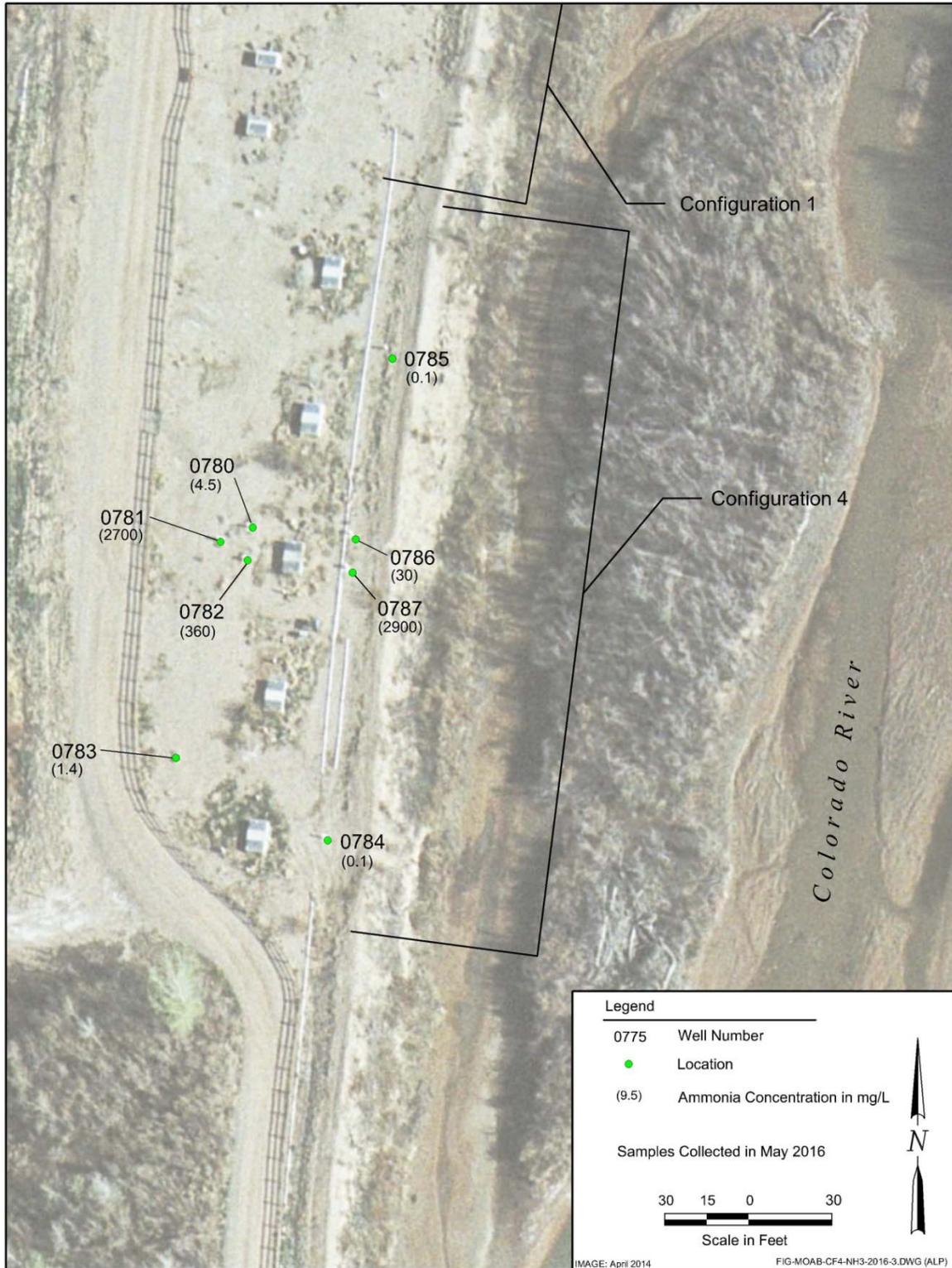


Figure 7. May 2016 CF4 Ground Water Ammonia Concentrations

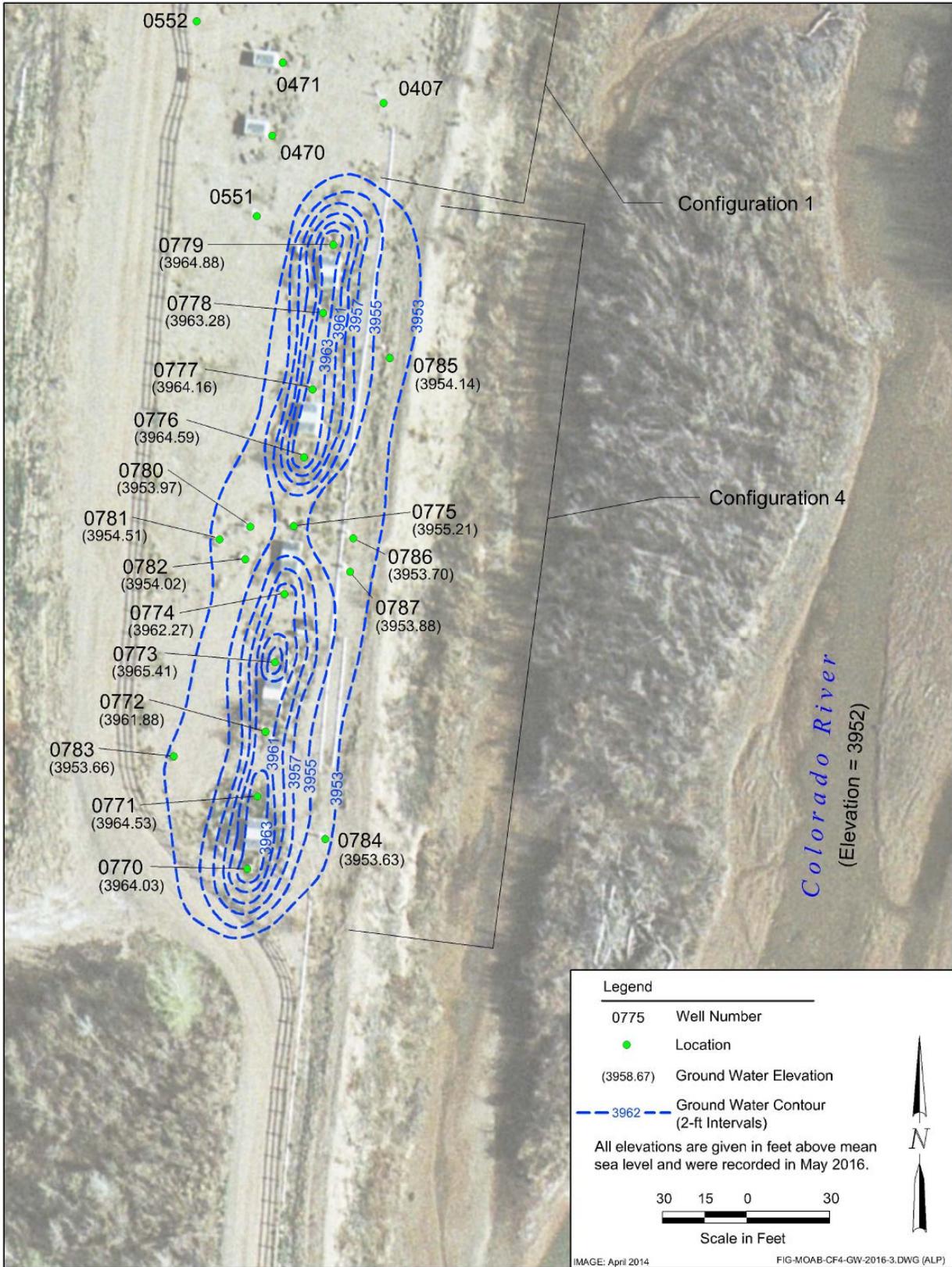


Figure 8. May 2016 CF4 Ground Water Elevation Contour Map during Injection

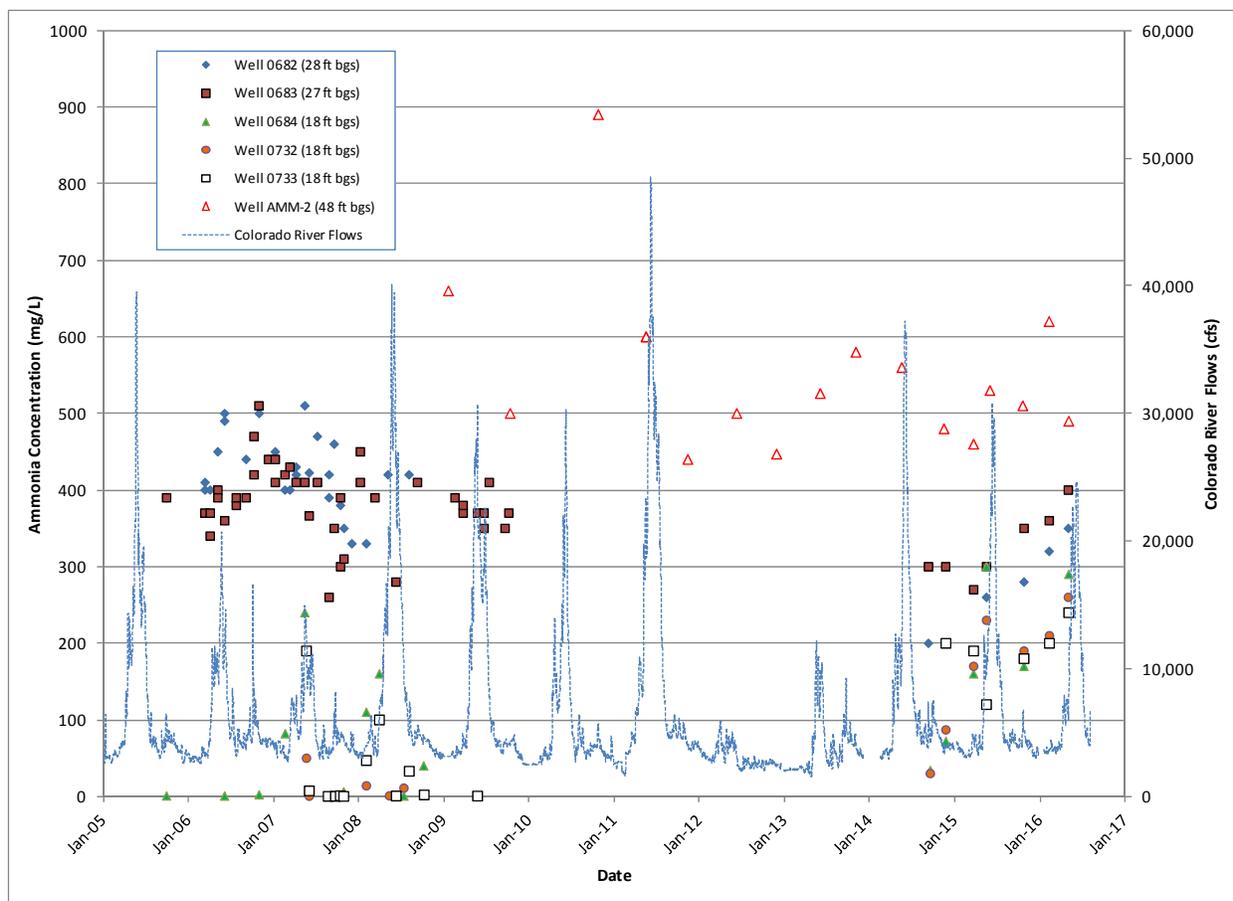


Figure 9. Ground Water Ammonia Concentrations in the Vicinity of the Tree Plot Area

4.5 June/July 2016 Site-wide Sampling Event Results

All samples collected during this event were analyzed for both ammonia and uranium. Table 23 presents all locations sampled that exceeded the 0.044 mg/L uranium ground water standard. This standard is based on Table 1 in Title 40 Code of Federal Regulations Part 192 (40 CFR 192) Subpart A, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites,” assuming uranium-234 and uranium-238 activities are in equilibrium.

To present the trends observed in the water chemistry for the site-wide locations, the site was divided into six areas. These include the northeastern base of the tailings pile, northeastern uranium plume (which includes the PW03 cluster), the southeastern base of the tailings pile, along the southwestern boundary, along the Colorado River bank, and south of the site. All results are also plotted against the Colorado River flow to determine if the river stage may impact the concentrations.

Table 23. January through July 2016 Sampling Events, Ground Water Locations Exceeding the 0.044 mg/L Uranium Ground Water Standard

Well Number	Date	Location	Sample Depth (ft bgs)	Uranium Concentration (mg/L)
0403	6/8/2016	CF1	18	0.37
0404	6/8/2016	CF3	18	1.7
0410	6/28/2016	NE Uranium Plume Area	24	0.45
0411	6/28/2016	NE Uranium Plume Area	8	2.4
0412	7/7/2016	NE Uranium Plume Area	10	1.7
0413	6/3/2016	NE Uranium Plume Area	10	3.7
0414	7/25/2016	NE Uranium Plume Area	8	4.0
0439	6/28/2016	On Tailings Pile	118	1.3
0441	6/14/2016	Support Area	117	0.065
0453	6/8/2016	Along SW Site Boundary	80	2.2
0454	6/7/2016	Along SW Site Boundary	13	0.95
0492	7/5/2016	Along S Site Boundary	18	0.047
0682	2/11/2016	CF3 / Tree Plot Vicinity	28	1.7
	5/3/2016			1.8
0683	2/11/2016	CF3 / Tree Plot Vicinity	28	1.6
	5/3/2016			1.8
0684	2/12/2016	CF3 / Tree Plot Vicinity	18	1.5
	5/5/2016			1.7
0732	2/12/2016	Tree Plot Vicinity	18	1.6
	5/3/2016			1.4
0733	2/12/2016	Tree Plot Vicinity	18	1.3
	5/5/2016			1.6
0781	2/2/2016	CF4	46	2.5
	5/2/2016			1.4
0782	2/2/2016	CF4	33	0.15
	5/2/2016			2.3
0783	2/11/2016	CF4	18	0.13
	5/3/2016			0.092
0786	5/3/2016	CF4	28	0.69
0787	2/8/2016	CF4	36	2.0
	5/3/2016			1.5
AMM-2	2/11/2016	CF5 Vicinity	48	1.9
	5/5/2016			2.0
	6/3/2016			2.0
AMM-3	6/6/2016	Near Base of Tailings Pile	48	2.5
MW-3	6/6/2016	CF5 Vicinity	44	2.9
SMI-PZ1S	2/12/2016	CF5 Vicinity	18	1.4
	5/5/2016			1.6
SMI-PZ2M2	6/6/2016	CF5 Vicinity	56	2.2

Table 23. January through June 2016 Sampling Events, Ground Water Locations Exceeding the 0.044 mg/L Uranium Ground Water Standard (continued)

Well Number	Date	Location	Sample Depth (ft bgs)	Uranium Concentration (mg/L)
MW-3	6/6/2016	CF5 Vicinity	44	2.9
SMI-PZ1S	2/12/2016	CF5 Vicinity	18	1.4
	5/5/2016			1.6
SMI-PZ2M2	6/6/2016	CF5 Vicinity	56	2.2
SMI-PZ3S	6/29/2016	NE Uranium Plume Area	25	0.99
TP-01	6/3/2016	NE Uranium Plume Area	22	0.055
TP-22	6/6/2016	NE Uranium Plume Area	17	0.41
TP-23	6/7/2016	NE Uranium Plume Area	25	2.4
UPD-17	6/29/2016	NE Uranium Plume Area	14	1.3
UPD-18	6/29/2016	NE Uranium Plume Area	13	2.0
UPD-20	6/29/2016	NE Uranium Plume Area	17	0.063
UPD-21	6/29/2016	NE Uranium Plume Area	25	6.2
UPD-22	6/3/2016	NE Uranium Plume Area	9	2.4
UPD-23	6/30/2016	NE Uranium Plume Area	26	0.49
UPD-24	6/29/2016	NE Uranium Plume Area	27	3.6

NE = northeastern; SW = southwestern

4.5.1 Northeastern Base of Tailings Pile

Figures 10 and 11 are time versus ammonia and uranium concentration plots, respectively, for locations UPD-17 and UPD-18. The ammonia concentrations display a general trend of higher ammonia concentrations during river base flows and, conversely, lower concentrations during the spring runoff or higher flows. This trend, however, did not apply this past sampling event, when the ammonia concentration in the sample collected from well UPD-17 continued to increase during higher flows. The uranium concentrations did not follow this general trend either, with the uranium concentration in the sample collected from well UPD-18 increased from 0.9 to 2 mg/L (Figure 11) since January 2016.

4.5.2 Northeastern Uranium Plume Area

Due to the number of wells associated with the northeastern uranium plume, this area of the site was further subdivided into the center of the plume, the vicinity of the Atlas building, and the northeastern edge of the plume area.

4.5.3 Center of Northeastern Uranium Plume Area

Figures 12 and 13 are the time versus ammonia and uranium concentration plots, respectively, for the center of the northeastern uranium plume area, which includes locations 0411, 0413, 0414, and UPD-20. As displayed in Figure 12, the ammonia concentrations remained lower than 10 mg/L in the samples collected from wells UPD-20 and 0411. Ammonia concentrations have ranged from 49 to 62 mg/L since June 2014 in samples collected from 0413, while the concentrations have steadily increased from 14 to 39 mg/L during the past year.

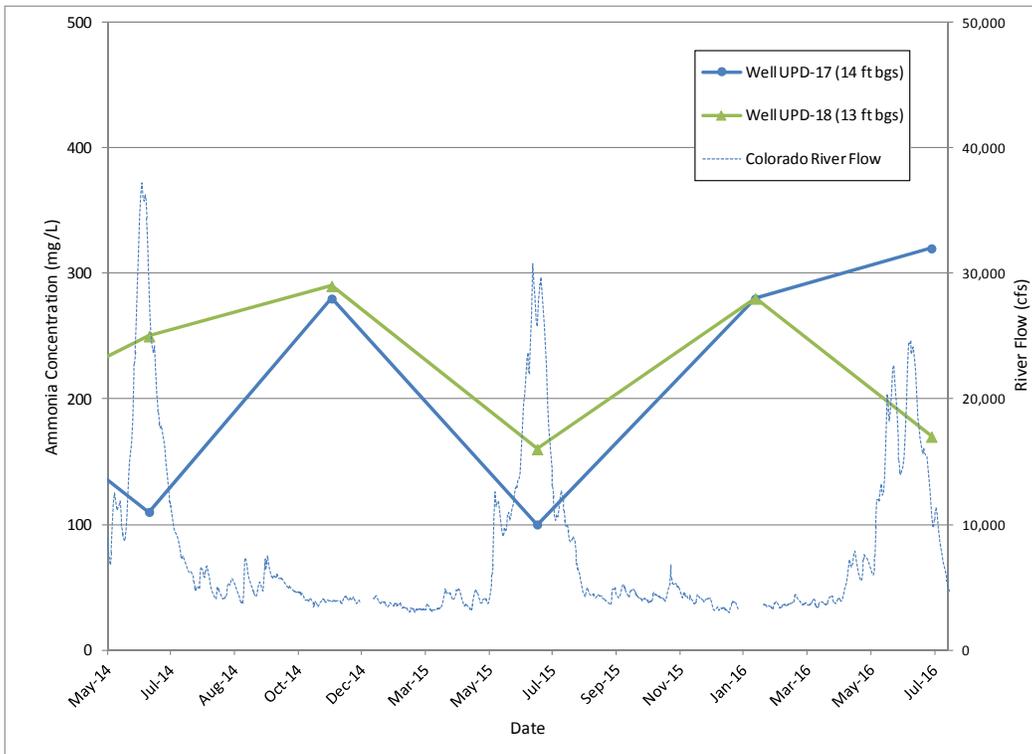


Figure 10. Wells UPD-17 and UPD-18 Time versus Ammonia Concentration Plot

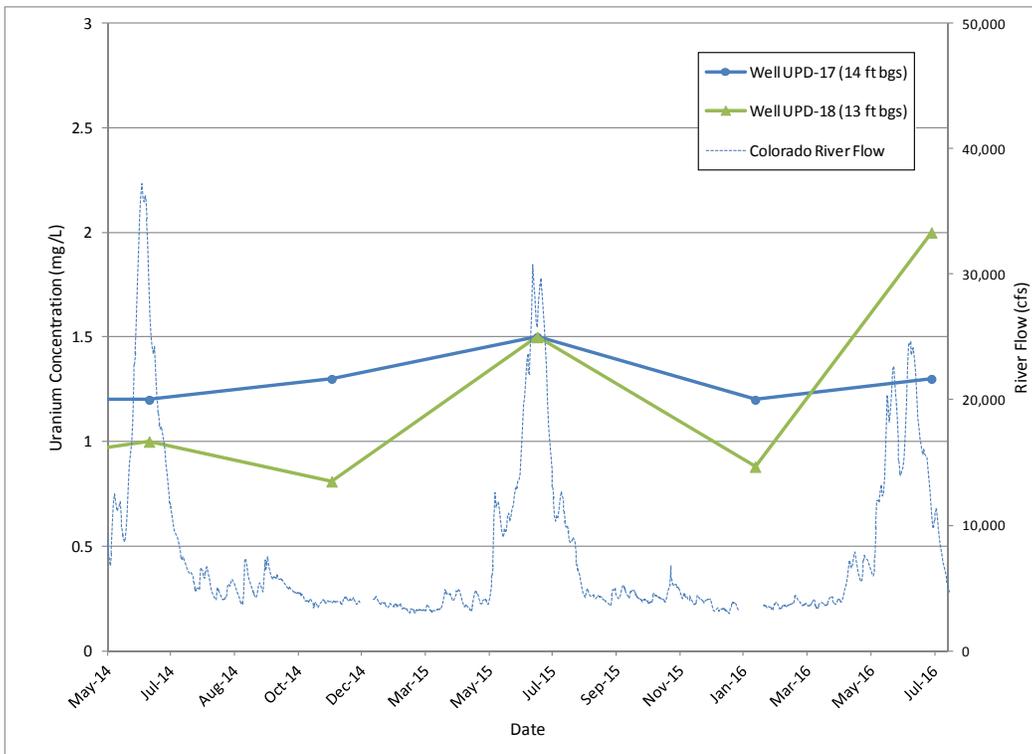


Figure 11. Wells UPD-17 and UPD-18 Time versus Uranium Concentration Plot

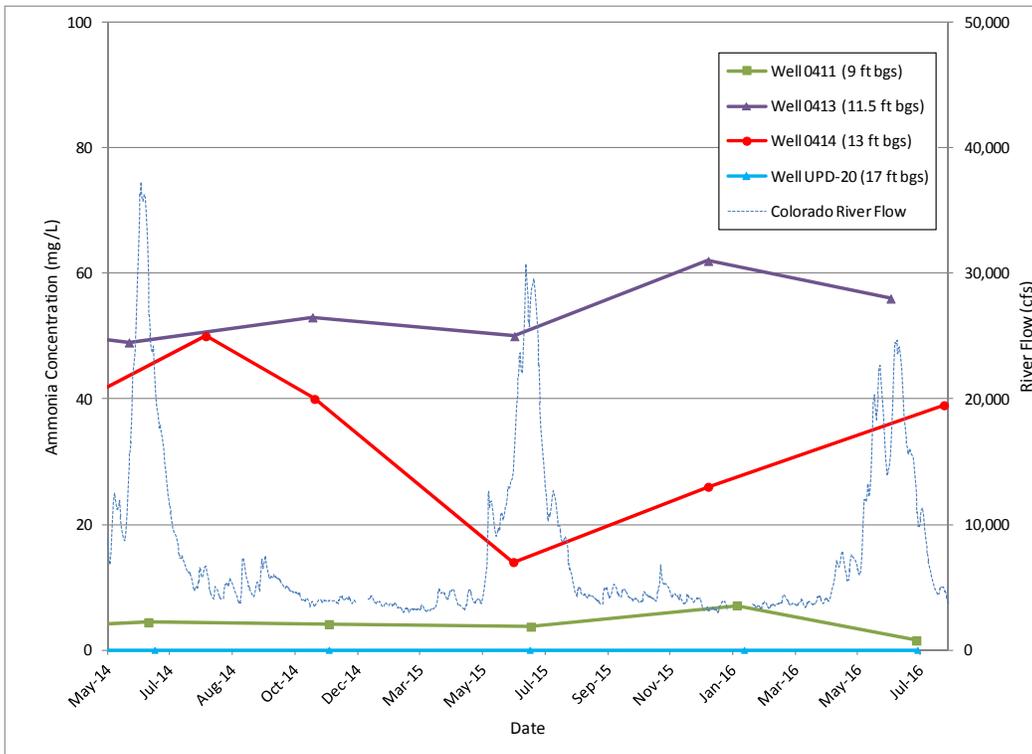


Figure 12. Center of Northeastern Uranium Plume Area Observation Wells 0411, 0413, 0414, and UPD-20 Time versus Ammonia Concentration Plot

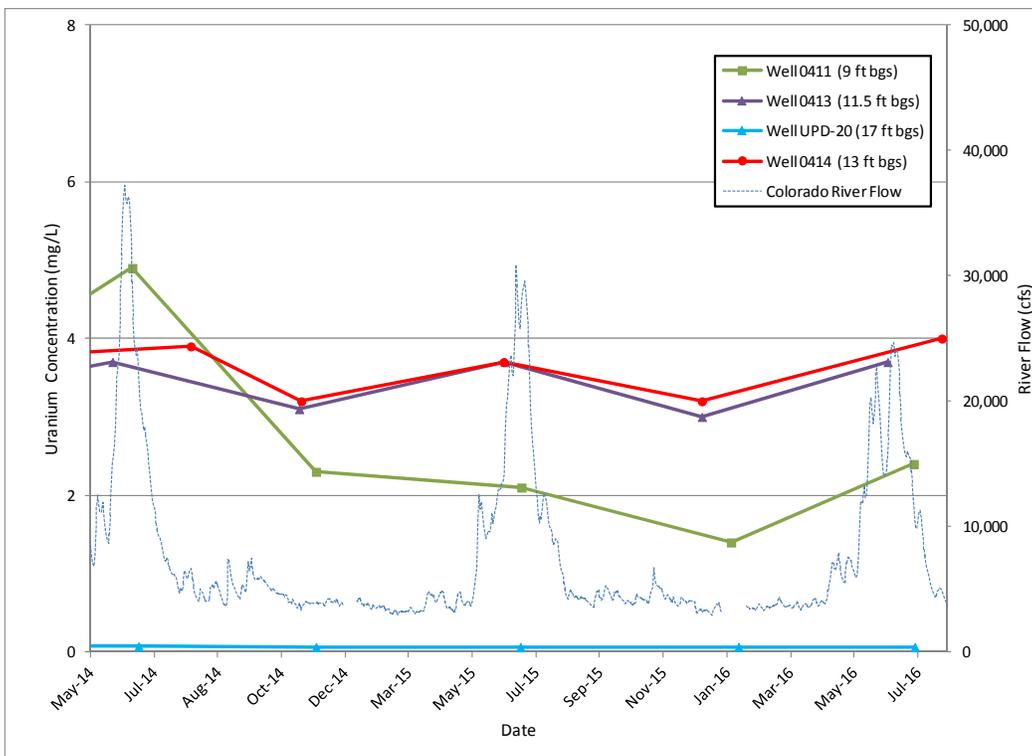


Figure 13. Center of Northeastern Uranium Plume Area Observation Wells 0411, 0413, 0414, and UPD-20 Time versus Uranium Concentration Plot

The uranium concentrations in samples collected from wells 0413, 0414, and UPD-20 have fluctuated at approximately the same percentage since December 2014, with all concentrations within the historical range (Figure 13). The sample collected from well UPD-20 remains lower than 0.1 mg/L.

4.5.4 Atlas Building Vicinity

The ammonia and uranium concentrations associated with samples collected from locations in the vicinity of the Atlas building are displayed in Figures 14 and 15, respectively. These wells include 0410, UPD-21, UPD-23, and UPD-24. As shown in Figure 14, the ammonia concentrations in the samples collected from wells 0410, UPD-23, and UPD-24 have not changed significantly, and all remain less than 2.5 mg/L. The concentration in the sample collected from well UPD-21 has fluctuated between 2.2 and 10 mg/L since May 2014.

A similar trend was observed in the uranium concentration (Figure 15) in the sample from UPD-21, where the concentration significantly decreased from 18 to 5.5 mg/L between December 2014 and June 2015 and then fluctuated between 5.5 and 6.9 mg/L since that time. The concentration in the sample from UPD-24 remains within the historical range, displaying seasonal fluctuation. Figure 15 also displays the uranium concentrations in samples collected from wells 0410 and UPD-23 are lower than 0.5 mg/L.

4.5.5 Northeastern Edge of Uranium Plume Area

Figures 16 and 17 display ammonia and uranium concentration data for the wells located in the vicinity of the northeastern edge of the plume area (wells 0412, UPD-22, SMI-MW01, and SMI-PZ3S). As Figure 16 exhibits, with the exception of the ammonia concentration in the sample collected from UPD-22 (which has gradually increased since November 2014), the concentrations have remained consistent since June 2014. During this time, the concentration in well SMI-PZ3S has ranged from 3.1 to 4.7 mg/L, and the concentration in well 0412 has remained at or lower than the detection limit of 0.1 mg/L. Well SMI-MW01 could not be sampled during this most recent event due to site conditions.

There is general trend of uranium concentrations gradually decreasing over the past 2 years in samples collected from these locations (Figure 17). Uranium concentrations in samples from wells UPD-22, 0412, and SMI-PZ3S have decreased from 2.9 to 2.4 mg/L, from 2 to 1.7 mg/L, and from 2 to 1 mg/L, respectively, during this time frame.

4.5.6 Base of Tailings Pile

The time versus ammonia and uranium concentration plots for the area near the base of the tailings pile are presented in Figures 18 and 19 for wells AMM-3, ATP-2-S, ATP-2-D, and MW-3 (listed from south to north). As Figure 18 exhibits, since June 2014, the ammonia concentrations in well MW-3 have not significantly changed (ranges between 460 and 490 mg/L), while the concentration in the samples collected from well AMM-3 have fluctuated between 200 and 320 mg/L. In general, the concentrations have gradually increased in samples collected from well ATP-2-S (from 365 to 490 mg/L) between June 2014 and June 2016.

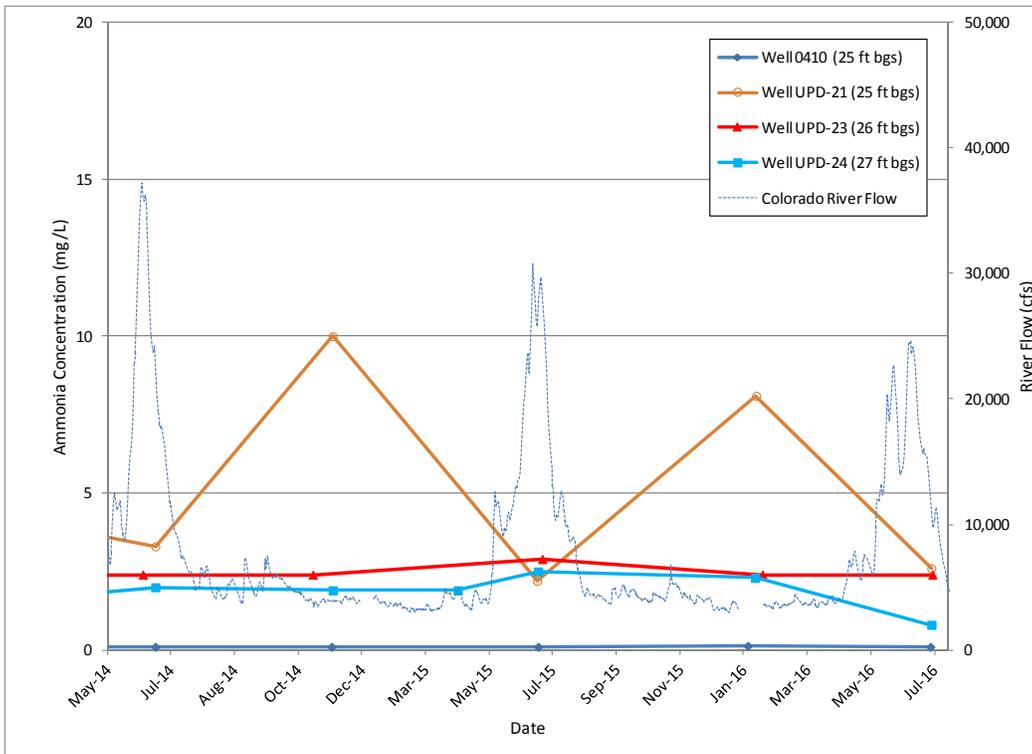


Figure 14. Vicinity of Atlas Building Observation Wells 0410, UPD-21, UPD-23, and UPD-24 Time versus Ammonia Concentration Plot

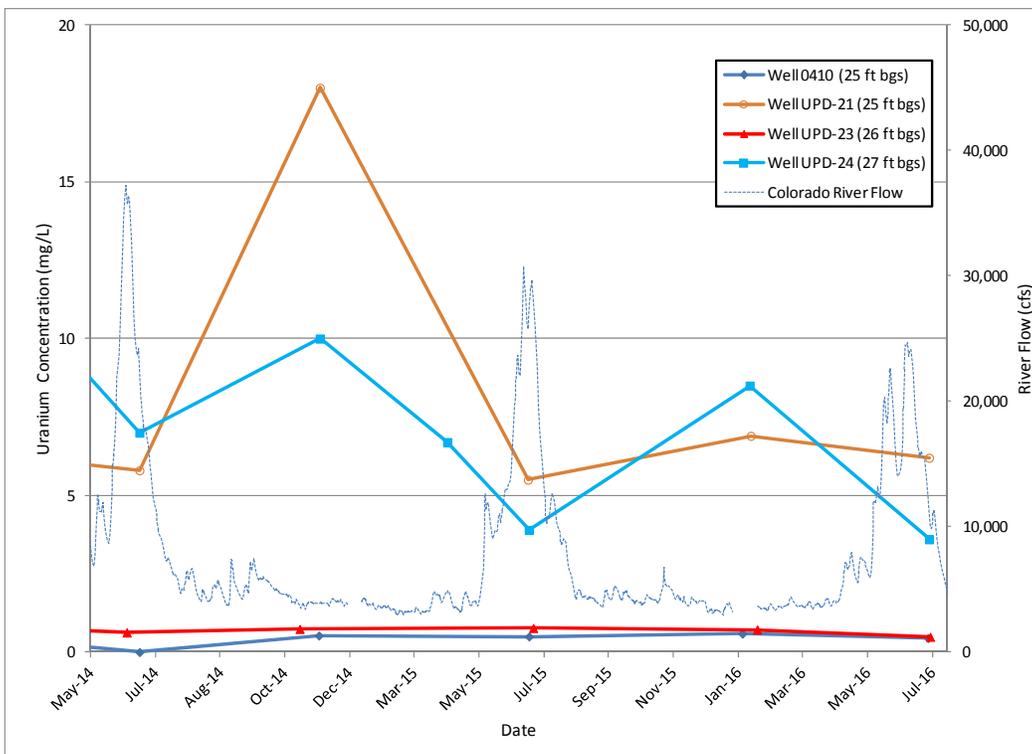


Figure 15. Vicinity of Atlas Building Observation Wells 0410, UPD-21, UPD-23, and UPD-24 Time versus Uranium Concentration Plot

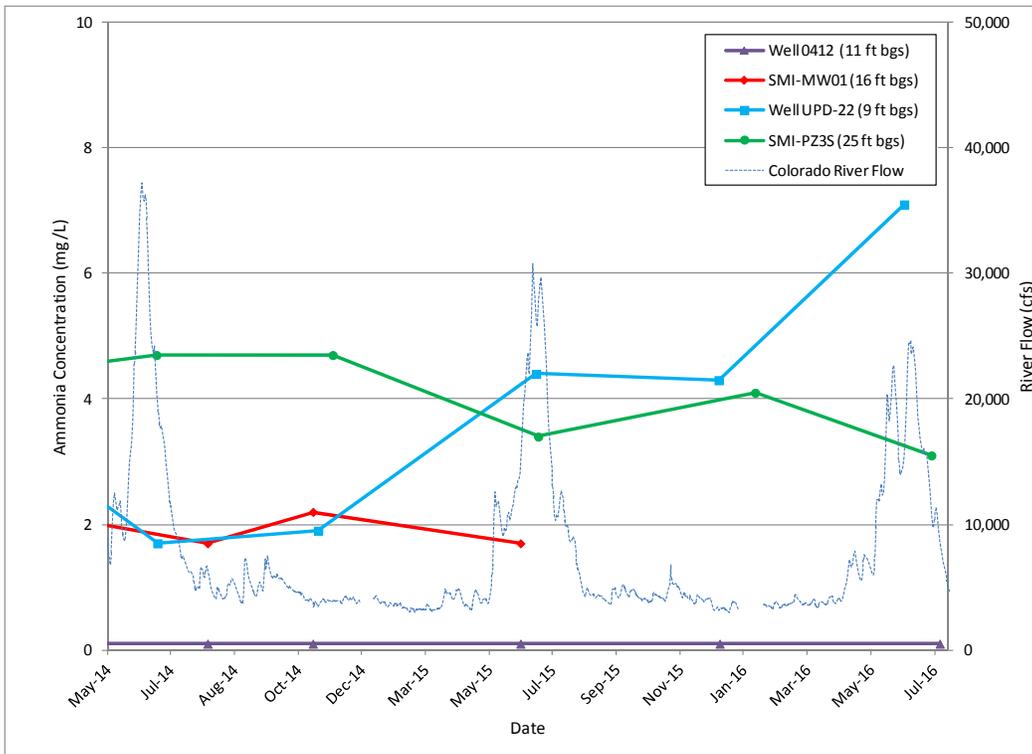


Figure 16. Northeastern Edge of Uranium Area Observation Wells 0412, SMI-MW01, SMI-PZ3S, and UPD-22 Time versus Ammonia Concentration Plot

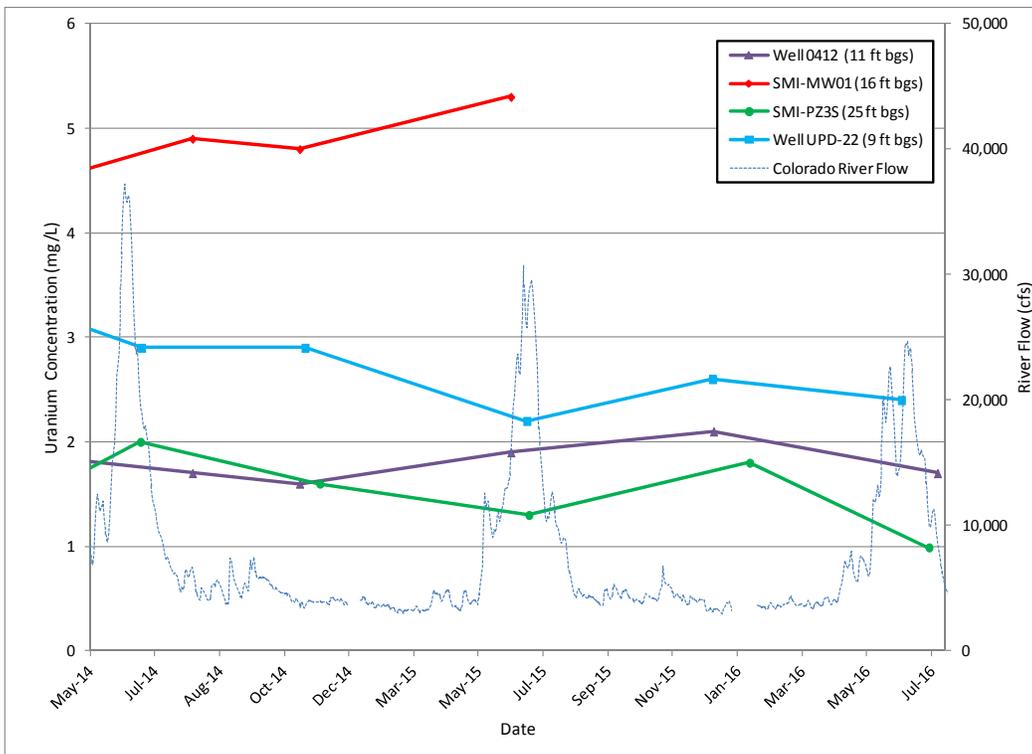


Figure 17. Northeastern Edge of Uranium Area Observation Wells 0412, SMI-MW01, SMI-PZ3S, and UPD-22 Time versus Uranium Concentration Plot

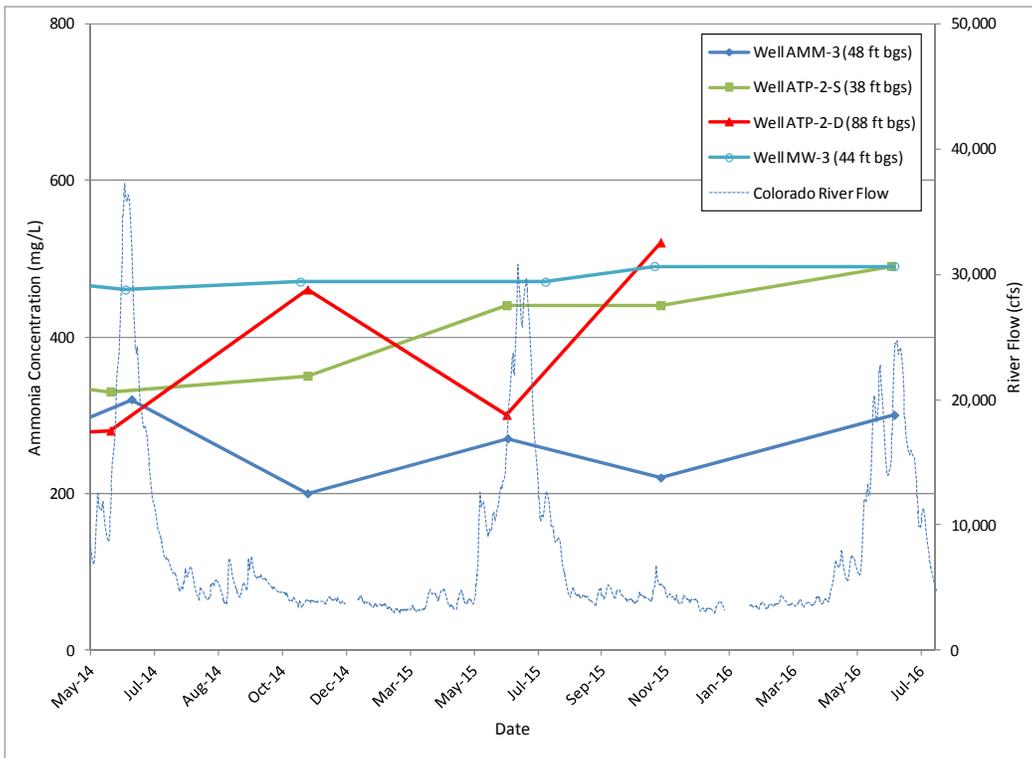


Figure 18. Base of Tailings Pile Observation Wells AMM-3, ATP-2-S, ATP-2-D, and MW-3 Time versus Ammonia Concentration Plot

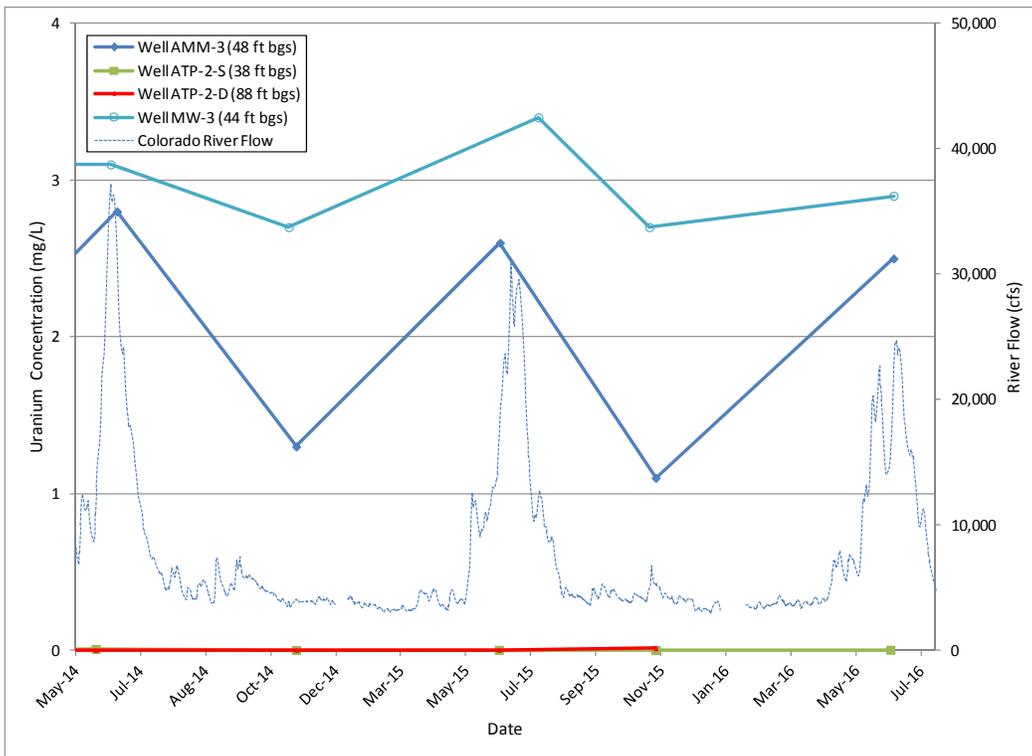


Figure 19. Base of Tailings Pile Observation Wells AMM-3, ATP-2-S, ATP-2-D, and MW-3 Time versus Uranium Concentration Plot

Uranium concentrations in wells ATP-2-S (sample depth 25 ft bgs) and ATP-2-D (sample depth 88 ft bgs) have been lower than 0.015 mg/L since 2010. Figure 19 suggests the uranium concentrations associated with the samples collected from wells MW-3 and AMM-3 continue to exhibit a strong seasonal fluctuation, which may be in response to the site flooding during spring runoff or flood irrigation activities over the past 2 years.

4.5.7 Southwestern Boundary

Figures 20 and 21 are time versus concentration plots for ammonia and uranium (respectively) for locations 0440, 0453, and 0454 (listed from northwest to southeast or from upgradient to downgradient ground water flow direction) along the southwestern site boundary.

Figure 20 displays the gradual decrease of the ammonia concentration measured in the sample collected from well 0454 since November 2014 (from 400 to 170 mg/L).

Since June 2014, well 0453 ammonia concentrations have seasonally fluctuated (higher concentrations during the winter months and lower concentrations in the summer months) between 200 and 410 mg/L, while concentrations in the samples collected from well 0440 (the furthest upgradient location) have been at or lower than the 0.1 mg/L detection limit since 2009.

The uranium concentrations (Figure 21) in the samples collected from well 0453 display the same seasonal fluctuation, with the concentrations ranging from 0.79 to 2.7 mg/L over the past 2 years.

Well 0454 uranium concentrations display a similar trend to the ammonia concentrations, with the uranium concentration decreasing since November 2014 from 2 to 0.95 mg/L. Samples collected from well 0440 have had a uranium concentration lower than the 0.044 mg/L UMTRA standard since 2009.

4.5.8 Riverbank Area

Figures 22 and 23 are the time versus ammonia and uranium concentration plots, respectively, for the locations sampled along the riverbank, presented from south to north (wells 0492, 0407, 0401, 0404, and TP-01).

Because these wells are located along the riverbank, their water chemistry is heavily influenced by the seasonal changes of the Colorado River stage. As opposed to decreasing during higher river flows, the concentration in the sample collected from well 0404 did not change since the previous sampling event.

Uranium concentrations (Figure 23) in this sample slightly increased over this same time period, from 1.4 to 1.7 mg/L. The expected seasonal trend is evident for the uranium concentrations measured at location 0492. The sample collected from well TP-01 all had an uranium concentration that slightly decreased since the December 2015.

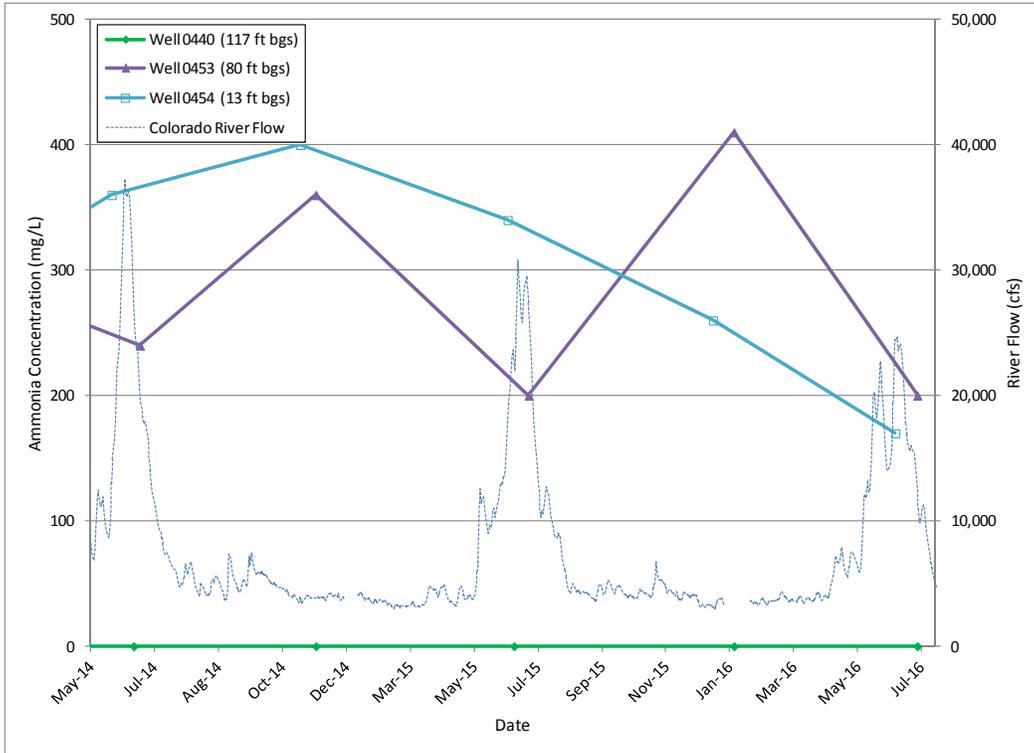


Figure 20. Southwestern Boundary Observation Wells 0453, 0454, and 0440 Time versus Ammonia Concentration Plot

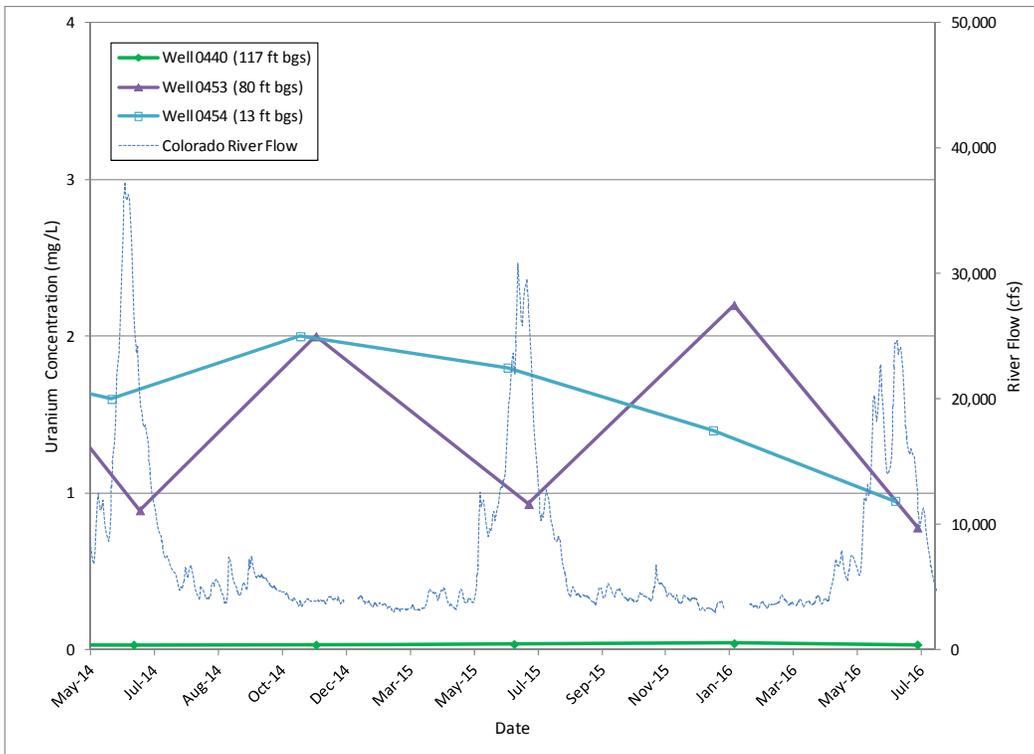


Figure 21. Southwestern Boundary Observation Wells 0453, 0454, and 0440 Time versus Uranium Concentration Plot

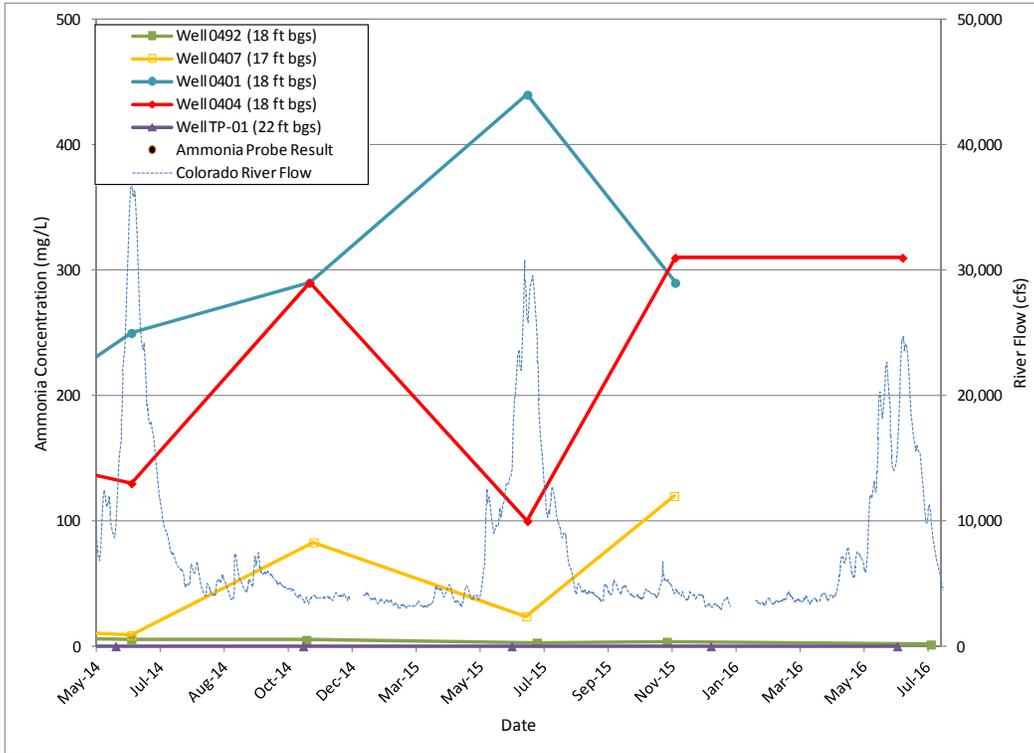


Figure 22. Riverbank Observation Wells 0492, 0407, 0401, 0404, and TP-01 Time versus Ammonia Concentration Plot

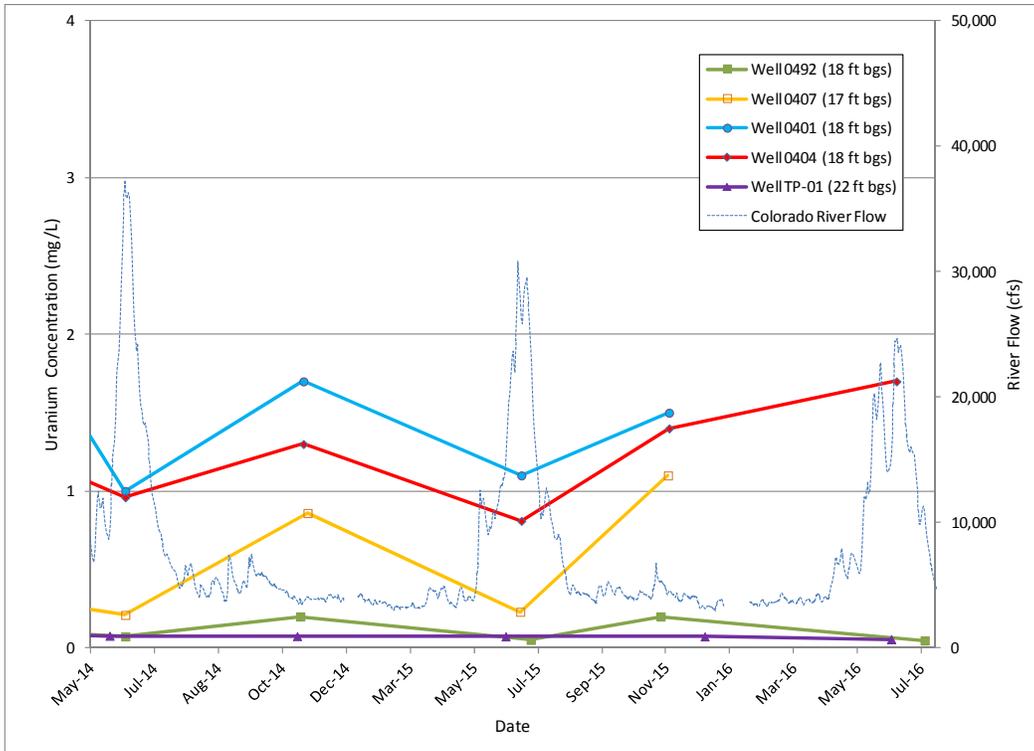


Figure 23. Riverbank Observation Wells 0492, 0407, 0401, 0404, and TP-01 Time versus Uranium Concentration Plot

4.5.9 Southern and Off-site Areas

Figures 24 and 25 are the plots for the two locations sampled south of the site, wells TP-17 and TP-20. Well TP-20 is located approximately 600 ft off the bank. Typically, ammonia and uranium concentrations are low at TP-20 because it is located along the southern edge of the contaminant plumes.

Ammonia concentrations (Figure 24) remain lower than 4 mg/L, with no significant changes since May 2014 in the samples collected from well TP-20, while the concentration in well TP-17, which gradually increased between since June 2014 and December 2015, decreased from 3.3 to 2 mg/L in June 2016.

The uranium concentrations (Figure 25), while displaying seasonal fluctuations, have consistently been lower than the 0.044 mg/L UMTRA standard since 2008. The uranium concentration in the sample collected from well TP-17 has gradually decreased since December 2014 from 0.027 to 0.012 mg/L.

4.5.10 Surface Water Sampling Results

Table 24 presents the ammonia results from the surface water sampling conducted in December 2015 from locations 0201, 0218, 0226, CR1, CR2, CR3, CR5, and Z (as shown on Figure 4). The ammonia concentrations and comparisons to the applicable EPA criteria for both acute and chronic concentrations (along with the temperature and pH data used to calculate these concentrations) are shown in Table 24.

The ammonia concentrations measured during this event, all of which were lower than 0.1 mg/L, were lower than both the acute and chronic criteria.

Table 24. June/July 2016 Surface Water Ammonia Concentrations and Comparisons to EPA Acute and Chronic Criteria

Location	Date	Temp (°C)	pH	Ammonia as N (mg/L)	EPA - Acute Total as N (mg/L)*	EPA - Chronic Total as N (mg/L)**
0201	7/6/16	23.15	7.72	<0.1	14	0.94
0218	6/30/16	22.47	7.94	<0.1	11	0.79
0226	7/5/16	21.94	7.92	<0.1	11	0.79
CR1	6/30/16	21.23	7.24	<0.1	31	1.6
CR2	6/30/16	22.9	8.03	<0.1	8.2	0.64
CR3	7/5/16	22.32	7.81	<0.1	13	0.79
CR5	7/6/16	22.66	7.92	<0.1	9.9	0.74
Z	7/6/16	23.65	8.02	<0.1	7.5	0.60

*U.S. EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013), Table N.4., Temperature and pH-Dependent Values, Acute Concentration of Total Ammonia as N (mg/L)

**U.S. EPA Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater State (Effective April 2013), Table 6., Temperature and pH-Dependent Values, Chronic Concentration of Total Ammonia as N (mg/L)

4.6 Ground Water Surface Elevation

Water level data were collected between July 11 and 13, 2016, when the Colorado River mean daily flows ranged from 5,910 to 6,670 cubic feet per second (cfs), and the river stage at the site ranged from only from 3,951.8 to 3,952.2 feet above mean sea level.

Because ground water elevations during spring runoff flow conditions fluctuate significantly during this time of the year, only the data collected during this time frame were used to generate the ground water surface contour map displayed in Figure 26. Ground water flow direction and gradient displayed in this contour map is comparable to historical contour maps generated using ground water data collected during this time of year.

4.7 Contaminant Distribution

Figures 27 and 28 are maps showing shallow ground water ammonia and uranium plumes, respectively, using data collected during the June/July 2016 site-wide events. Contaminant distribution is generally comparable to previous plume maps generated using data collected during the past 2 years.

While Figure 28 displays the results associated with well ATP-2-S, this uranium concentration was not taken into consideration for the contour line location. This well is screened over a deeper interval in this shallow zone and is not representative of the uranium concentration in the shallowest ground water.

5.0 Conclusions

5.1 February 2016 CF4 and Tree Plot Sampling Event

The rationale for the collection of ground water samples from observation wells surrounding the CF4 injection wells was to evaluate the effectiveness of the freshwater injection system. At the time of the sampling event, the system had been actively injecting filtered freshwater consistently since January 2016. The results indicate the injection system reduced the ammonia concentrations within the subsurface shallow zone (15 to 35 ft bgs). Water elevation data confirmed up to 12 ft of mounding was generated from this system.

Five ground water samples downgradient and one upgradient of the tree plot area (near CF3) were collected to determine if phytoremediation had impacted ammonia concentrations. The influence of phytoremediation on the ground water system is difficult to determine because of the other hydrogeologic impacts to the tree plot area in the vicinity of CF3. Flood irrigation between the months of April and September has taken place inside the tree plot since 2005/2006 and upgradient to the tree plot since 2010. CF5 ground water extraction and the area's close proximity to the riverbank further impact the ammonia concentrations.

With the exception of the ground water samples collected from well 0782 (which had an ammonia concentration that was greater than 50 percent below the minimum) and well 0787 (an uranium concentration that was more than 50 percent above the maximum), all ammonia and uranium concentrations were within 50 percent of historical ranges during this sampling event.

These same locations were also sampled in May 2016, and Section 5.4 provides the conclusions associated the both the February and May 2016 events.

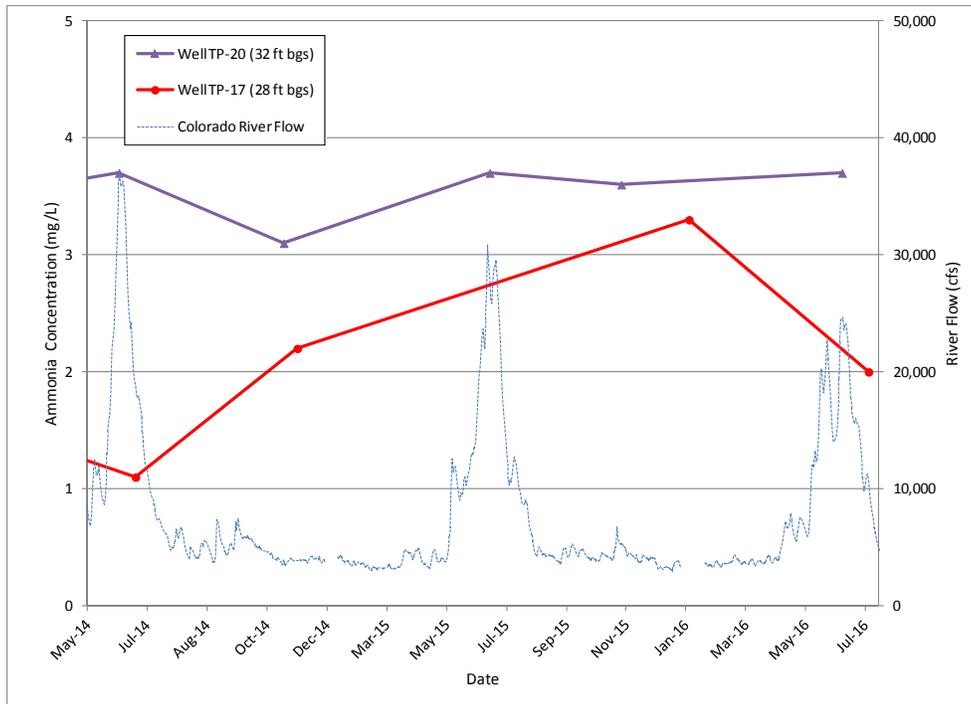


Figure 24. South of Site Observation Wells TP-17 and TP-20 Time versus Ammonia Concentration Plot

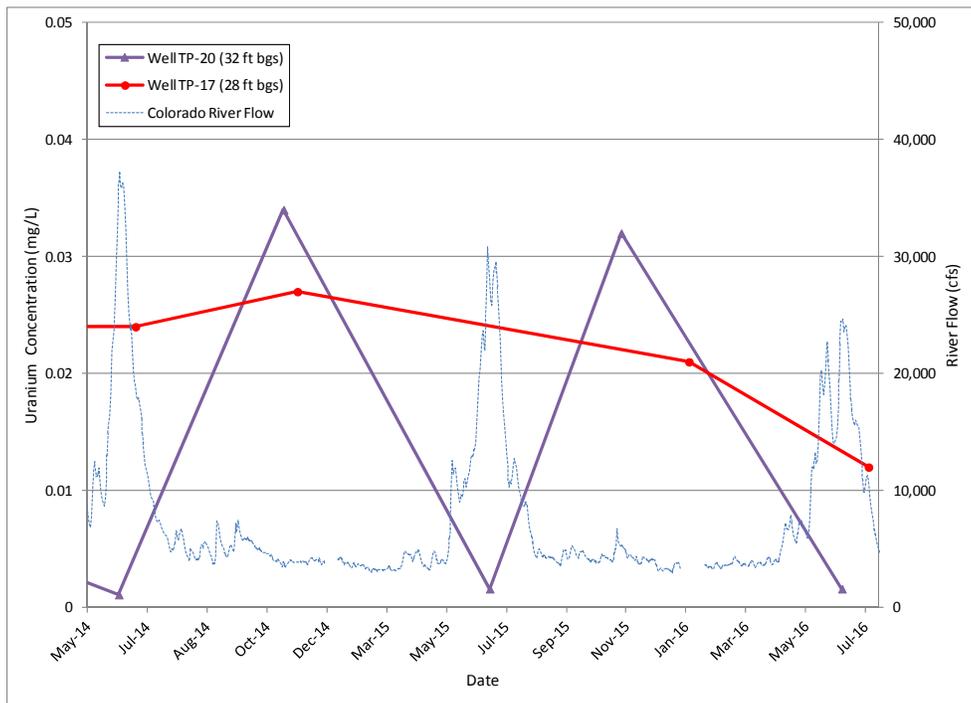


Figure 25. South of Site Observation Wells TP-17 and TP-20 Time versus Uranium Concentration Plot

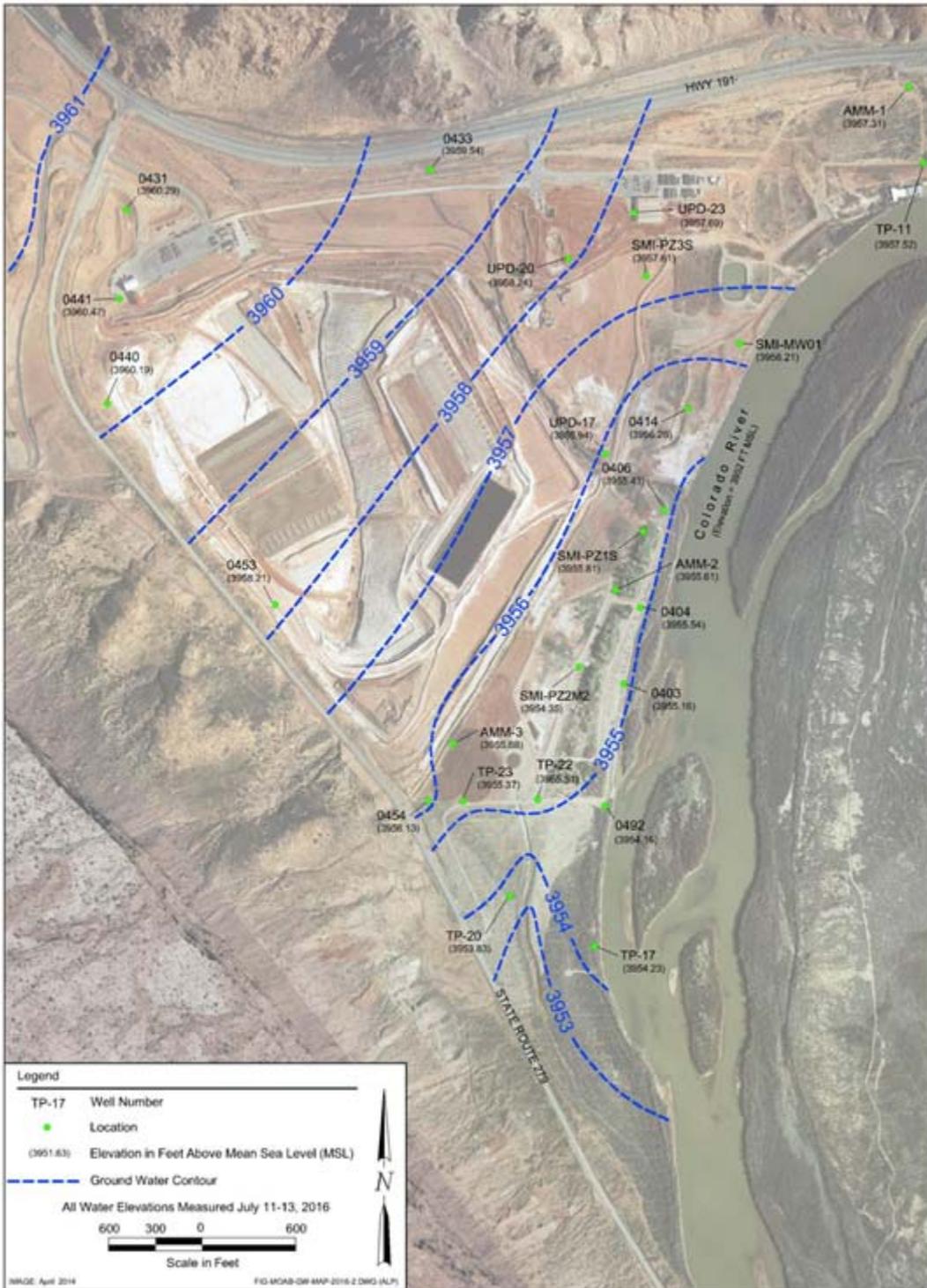


Figure 26. Site-wide Ground Water Elevations, July 11 through 13, 2016

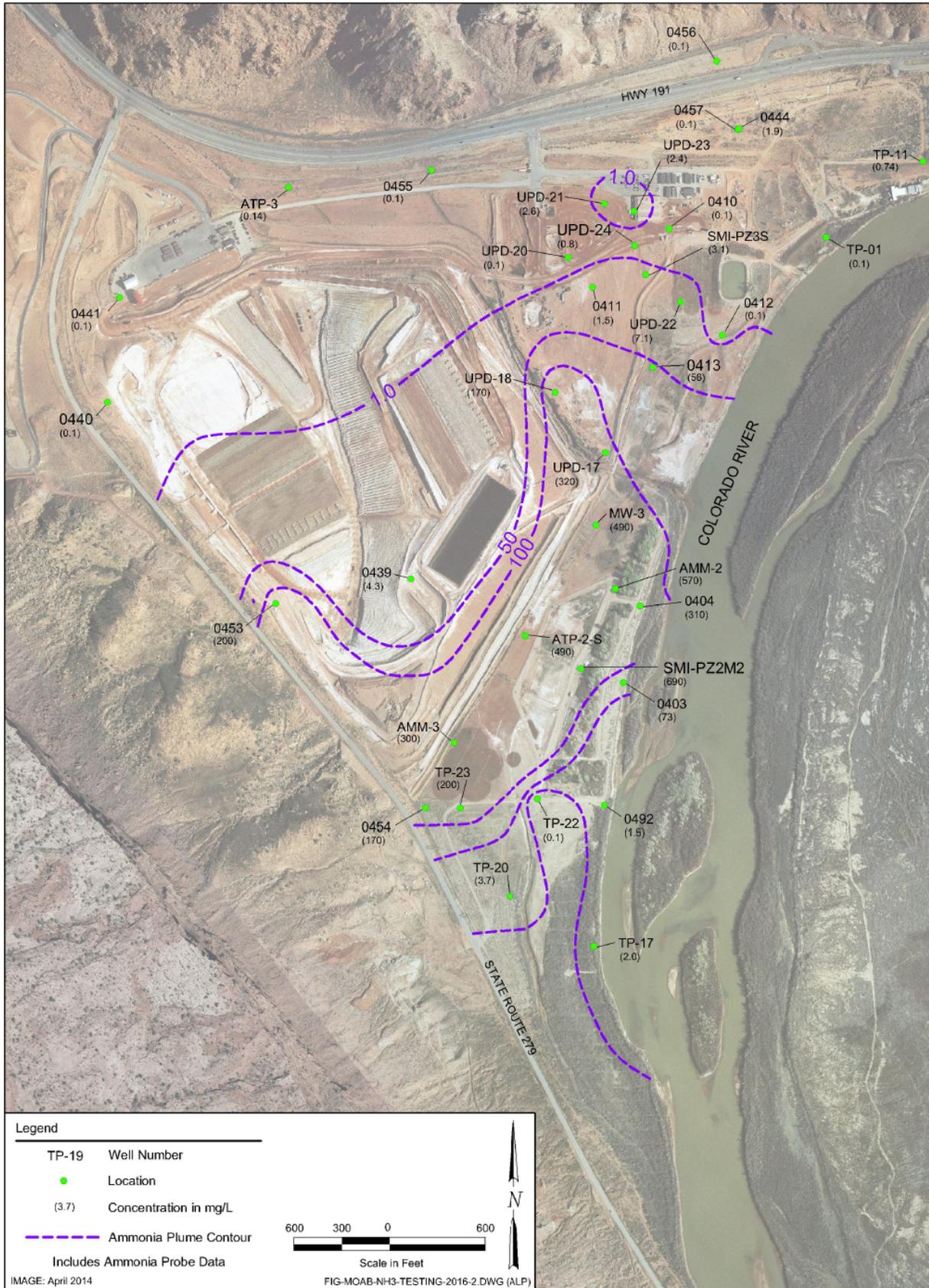


Figure 27. Ammonia Plume in Shallow Ground Water June/July 2016

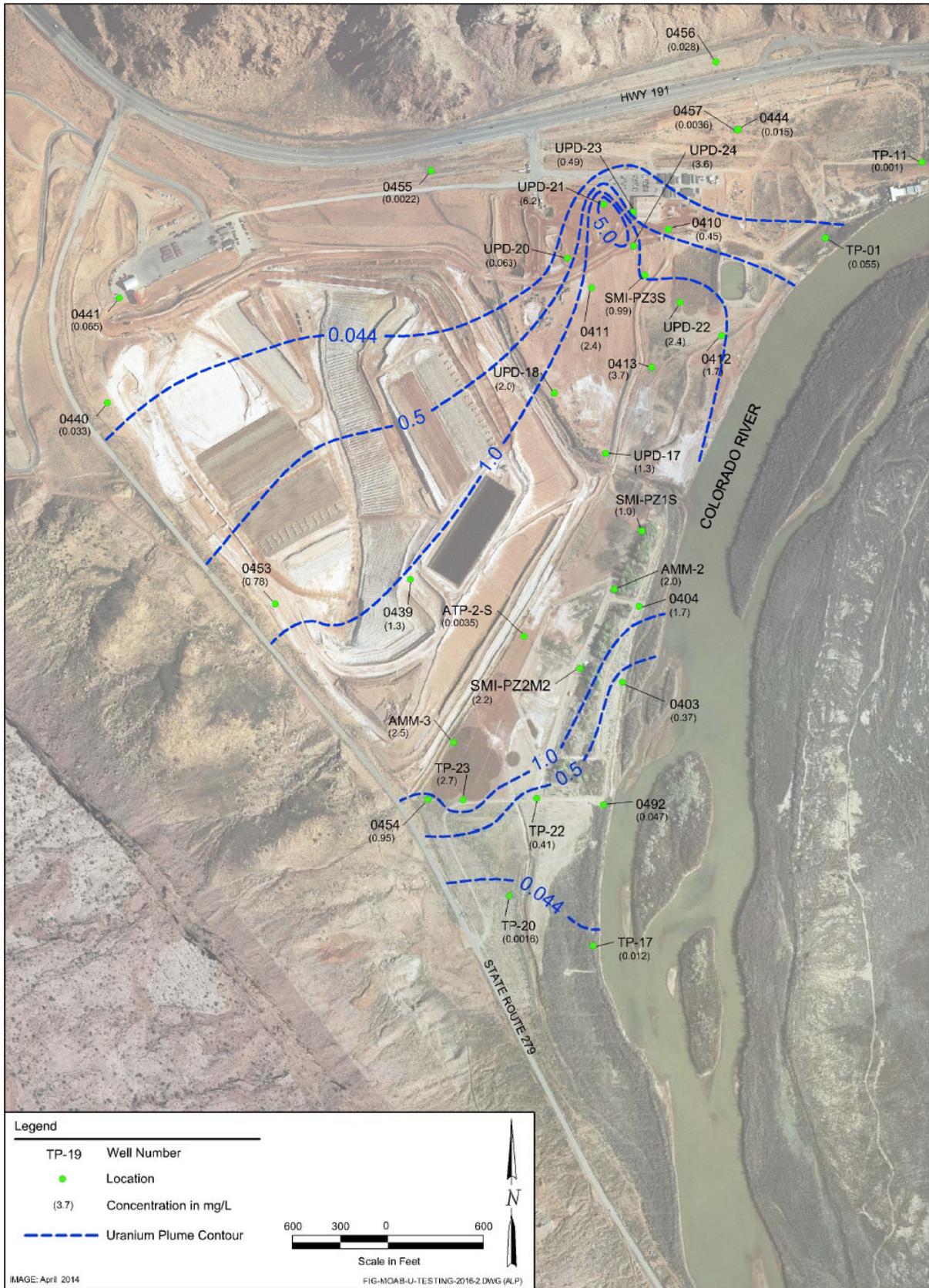


Figure 28. Uranium Plume in Shallow Ground Water June/July 2016

5.2 February 2016 Crescent Junction Sampling Event

The rationale for collecting one ground water sample from Crescent Junction monitoring well 0205 and one soil sample of the tailings placed inside the disposal cell was to identify the source of the water present in well 0205. The ground water sample was collected as part of the quarterly monitoring for the first quarter of 2016. In addition to the standard analytes, the sample was also analyzed for nitrate as N, nitrite as N, and total organic carbon. The analyte concentrations of the well 0205 sample did not significantly change since the November 2015 and in general the concentrations were similar to those detected since the well was sampled in late July 2015. The nitrate/nitrite analysis indicated the nitrogen is all in the form of nitrate.

The soil samples were used in a leachate batch test conducted by ALS. Based on the analysis, the concentrations represent a dilution of what could be expected to be present in ground water. Because this event represents the fourth time samples were collected after the well was modified in 2011 (the well was backfilled from 300 to 65 ft bgs), there were no anomalous data because fewer than five samples have historically been collected.

5.3 April 2016 Crescent Junction Sampling Event

Well 0205 was sampled again in April 2016 as part of the second quarter monitoring event at the Crescent Junction site. This sample was the fifth sample collected at this location since mid-July 2015. In addition to the standard analytes, the sample was also analyzed for bicarbonate as CaCO_3 , carbonate as CaCO_3 , and total alkalinity as CaCO_3 . These results will be used to differentiate between the different water types encountered historically and over the past year for this investigation. The analyte concentrations of the well 0205 sample did not significantly change since the February 2016 and in general the concentrations were similar to those detected since the well was sampled in late July 2015. Subsequent sampling, in addition to the sampling results associated with this sampling event, will provide further data to assist with identifying the water source.

5.4 May 2016 CF4 and Tree Plot Sampling Event

The rationale for the collection of ground water samples from observation wells surrounding the CF4 injection wells was to evaluate the effectiveness of the freshwater injection system and the impacts of a higher river stage. At the time of the sampling event, the system had been actively injecting filtered freshwater consistently since January 2016. The results indicate the injection system continued to reduce the ammonia concentrations within the subsurface shallow zone (15 to 35 ft bgs). Water elevation data confirmed up to 12 ft of mounding was generated from this system.

The ammonia concentrations in samples collected from the five downgradient locations displayed in general a gradual increase since the locations were sampled in mid-May 2015. During this same timeframe the upgradient well ammonia concentration has fluctuated between 460 and 620 mg/L, with a sharp decrease from 620 to 490 mg/L between February and May 2016. Based on the most recent data, there are no definitive explanations regarding impacts of phytoremediation on the ground water system in this vicinity of the site. Subsequent and more frequent sampling of these locations has been scheduled.

With the exception of the ground water sample collected from well 0787 (which contained an ammonia concentration that was more than 50 percent above the maximum), all ammonia and uranium concentrations were within 50 percent of historical ranges during this sampling event.

5.5 June/July 2016 Site-wide Sampling Event

The rationale for conducting the June/July 2016 site-wide sampling event was to collect data from the site when the Colorado River typically experiences peak runoff flows and to assess any changes and trends in the ground water system water chemistry. Surface water sampling was also conducted to assess surface water quality adjacent to the site compared to the upstream and downstream water quality.

In general, with the exception of the locations in the vicinity of the Colorado River bank, the ammonia and uranium concentrations did not significantly change since the previous site-wide sampling event in December 2015/January 2016. Concentrations associated with locations impacted by the river stage tend to decrease during this time of the water year.

With the exception of one ground water sample analyzed for ammonia (which contained an ammonia concentration that was more than 50 percent above the historic maximum), all ammonia and uranium concentrations in the site-wide wells were within 50 percent of historical ranges during this sampling event. All surface water samples collected during this sampling event had ammonia concentrations below the 0.1 mg/L detection limit, and thus below the applicable EPA criteria (for a suitable habitat) for both acute and chronic concentrations.

The rationale for conducting the December 2015/January 2016 site-wide sampling event was to collect data from the site when the Colorado River typically experiences base flows and to assess any changes and trends in the ground water system water chemistry. Surface water sampling was also conducted to assess surface water quality adjacent to the site compared to the upstream and downstream water quality. Only three of the seven usual surface water locations were accessible due to site conditions.

In general, with the exception of the locations in the vicinity of the Colorado River bank, the ammonia and uranium concentrations did not significantly change since the previous site-wide sampling event in May/June 2015. Concentrations associated with locations impacted by the river stage tend to increase during this time of the water year.

With the exception of one surface water sample analyzed for ammonia (which was 0.01 mg/L higher than the anomalous data criteria of 50 percent higher than the maximum), all ammonia and uranium concentrations in the site-wide wells were within 50 percent of historical ranges during this sampling event. All surface water samples collected during this sampling event had ammonia concentrations lower than the applicable EPA criteria (for a suitable habitat) for both acute and chronic concentrations.

6.0 References

40 CFR 192A (Code of Federal Regulations) Subpart A, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites.”

DOE (U.S. Department of Energy), *Moab UMTRA Project Operations and Maintenance Manual* (DOE-EM/GJTAC1973).

DOE (U.S. Department of Energy), *Moab UMTRA Project Surface Water/Ground Water Sampling and Analysis Plan* (DOE-EM/GJTAC1830).

DOE (U.S. Department of Energy), *Moab UMTRA Project Standard Practice for Validation of Laboratory Data* (DOE-EM/GJTAC1855).

Appendix A.
February 2016 CF4 and Tree Plot Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix A. February 2016 CF4 and Tree Plot Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	February 2016 CF4 and Tree Plot Sampling Event /1602082	Date(s) of Water Sampling	February 2-12, 2016
Date(s) of Verification	April 12, 2016	Name of Verifier	Ken Pill
		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan (SAP) the primary document directing field procedures? List other documents, standard operating procedures, instructions.	Yes	
		NA	
2.	Were the sampling locations specified in the planning documents sampled?	Yes	
3.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4.	Was an operational check of the field equipment conducted in accordance with the SAP? Did the operational checks meet criteria?	Yes	
		Yes	
5.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
6.	Was the category of the well documented?	Yes	
7.	Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling? Did the water level stabilize before sampling? Did pH, specific conductance, and turbidity measurements stabilize before sampling? Was the flow rate less than 500 milliliters per minute? If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	Yes	
		Yes	
		Yes	
		Yes	
8.	Were the following conditions met when purging a Category II well: Was the flow rate less than 500 milliliters per minute? Was one pump/tubing volume removed before sampling?	Yes	
		Yes	
9.	Were duplicates taken at a frequency of one per 20 samples?	Yes	One duplicate sample was collected for 15 samples

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Sampling Field Activities Verification (continued)

Sampling Event/RIN	February 2016 CF4 and Tree Plot Sampling Event /1602082	Date(s) of Water Sampling	February 2-12, 2016
Date(s) of Verification	April 12, 2016	Name of Verifier	Ken Pill
	Response (Yes, No, NA)	Comments	
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.	
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA		
12. Were quality-control samples assigned a fictitious site identification number?	Yes		
13. Was the true identity of the samples recorded on the quality assurance sample log?	Yes		
14. Were samples collected in the containers specified?	Yes		
15. Were samples filtered and preserved as specified?	Yes		
16. Were the number and types of samples collected as specified?	Yes		
17. Were COC records completed, and was sample custody maintained?	Yes		
18. Are field data sheets signed and dated by both team members?	Yes		
19. Was all other pertinent information documented on the field data sheets?	Yes		
20. Was the presence or absence of ice in the cooler documented at every sample location?	Yes		
21. Were water levels measured at the locations specified in the planning documents?	Yes		

Appendix A. February 2016 CF4 and Tree Plot Sampling Event *(continued)*

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters

Laboratory: ALS

RIN: 1602082

Comparison: All Historical Data

Report Date: 9/5/2016

Site Code	Location Code	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Count	
				Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	N	N Below Detect		
MOA01	0781	02/02/2016	Uranium	2.5		2.4		0.032	J		34	0	
MOA01	0782	02/02/2016	Ammonia Total as N	0.1	U	2300		0.9			41	0	
MOA01	0787	02/08/2016	Uranium	2		0.91		0.022			42	0	

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used. G Possible grout contamination, pH > 9. J Estimated value.
- L Less than 3 bore volumes purged prior to sampling. Q Qualitative result due to sampling technique. R Unusable result.
- U Parameter analyzed for but was not detected. X Location is undefined.

QA QUALIFIER:# Validated according to quality assurance guidelines.

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 9/5/2016
Location: 0682 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/11/2016	0001	28 -	320		J	#	0.1	
Oxidation Reduction Potential	mV	02/11/2016	N001	28 -	115			#		
pH	s.u.	02/11/2016	N001	28 -	7.1			#		
Specific Conductance	umhos/cm	02/11/2016	N001	28 -	14371			#		
Temperature	C	02/11/2016	N001	28 -	15.94			#		
Turbidity	NTU	02/11/2016	N001	28 -	1.5	>		#		
Uranium	mg/L	02/11/2016	0001	28 -	1.7		J	#	0.00029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 9/5/2016
Location: 0683 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/11/2016	0001	28 -	360		J	#	0.1	
Oxidation Reduction Potential	mV	02/11/2016	N001	28 -	123			#		
pH	s.u.	02/11/2016	N001	28 -	7.07			#		
Specific Conductance	umhos/cm	02/11/2016	N001	28 -	14604			#		
Temperature	C	02/11/2016	N001	28 -	15.72			#		
Turbidity	NTU	02/11/2016	N001	28 -	2.97	>		#		
Uranium	mg/L	02/11/2016	0001	28 -	1.6		J	#	0.00029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0684 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/12/2016	0001	18 -	200		J	#	0.1	
Oxidation Reduction Potential	mV	02/12/2016	N001	18 -	237			#		
pH	s.u.	02/12/2016	N001	18 -	7.05			#		
Specific Conductance	umhos/cm	02/12/2016	N001	18 -	12871			#		
Temperature	C	02/12/2016	N001	18 -	15.31			#		
Turbidity	NTU	02/12/2016	N001	18 -	2.03	>		#		
Uranium	mg/L	02/12/2016	0001	18 -	1.5		J	#	0.00029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0732 WELL Infiltration Trench

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/12/2016	0001	18 -	210		J	#	0.1	
Oxidation Reduction Potential	mV	02/12/2016	N001	18 -	231			#		
pH	s.u.	02/12/2016	N001	18 -	7.01			#		
Specific Conductance	umhos/cm	02/12/2016	N001	18 -	13014			#		
Temperature	C	02/12/2016	N001	18 -	14.95			#		
Turbidity	NTU	02/12/2016	N001	18 -	1.03	>		#		
Uranium	mg/L	02/12/2016	0001	18 -	1.6		J	#	0.00029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0733 WELL Infiltration Trench

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/12/2016	0001	18 -	200		J	#	0.1	
Oxidation Reduction Potential	mV	02/12/2016	N001	18 -	225			#		
pH	s.u.	02/12/2016	N001	18 -	7.04			#		
Specific Conductance	umhos/cm	02/12/2016	N001	18 -	12143			#		
Temperature	C	02/12/2016	N001	18 -	15.11			#		
Turbidity	NTU	02/12/2016	N001	18 -	1.55	>		#		
Uranium	mg/L	02/12/2016	0001	18 -	1.3		J	#	0.00029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0780 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/02/2016	0001	28 -	0.98		J	#	0.1	
Oxidation Reduction Potential	mV	02/02/2016	N001	28 -	-16			#		
pH	s.u.	02/02/2016	N001	28 -	7.36			#		
Specific Conductance	umhos/cm	02/02/2016	N001	28 -	1185			#		
Temperature	C	02/02/2016	N001	28 -	7.57			#		
Turbidity	NTU	02/02/2016	N001	28 -	2.63	>		#		
Uranium	mg/L	02/02/2016	0001	28 -	0.0099		J	#	0.000029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0781 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/02/2016	0001	46 -	2100		J	#	2.5	
Oxidation Reduction Potential	mV	02/02/2016	N001	46 -	242			#		
pH	s.u.	02/02/2016	N001	46 -	6.63			#		
Specific Conductance	umhos/cm	02/02/2016	N001	46 -	73480			#		
Temperature	C	02/02/2016	N001	46 -	12.03			#		
Turbidity	NTU	02/02/2016	N001	46 -	1.05			#		
Uranium	mg/L	02/02/2016	0001	46 -	2.5		J	#	0.00029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0782 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/02/2016	0001	33 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	02/02/2016	N001	33 -	16			#		
pH	s.u.	02/02/2016	N001	33 -	6.99			#		
Specific Conductance	umhos/cm	02/02/2016	N001	33 -	2301			#		
Temperature	C	02/02/2016	N001	33 -	8.47			#		
Turbidity	NTU	02/02/2016	N001	33 -	0.9	>		#		
Uranium	mg/L	02/02/2016	0001	33 -	0.15		J	#	0.000029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0783 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/11/2016	0001	18 -	2		J	#	0.1	
Oxidation Reduction Potential	mV	02/11/2016	N001	18 -	59			#		
pH	s.u.	02/11/2016	N001	18 -	7.51			#		
Specific Conductance	umhos/cm	02/11/2016	N001	18 -	1829			#		
Temperature	C	02/11/2016	N001	18 -	14.98			#		
Turbidity	NTU	02/11/2016	N001	18 -	2.13	>		#		
Uranium	mg/L	02/11/2016	0001	18 -	0.13		J	#	0.000029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0784 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/08/2016	0001	18 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	02/08/2016	N001	18 -	-6			#		
pH	s.u.	02/08/2016	N001	18 -	7.37			#		
Specific Conductance	umhos/cm	02/08/2016	N001	18 -	1222			#		
Temperature	C	02/08/2016	N001	18 -	6.42			#		
Turbidity	NTU	02/08/2016	N001	18 -	3.14	>		#		
Uranium	mg/L	02/08/2016	0001	18 -	0.01		J	#	0.000029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0785 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/08/2016	0001	18 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	02/08/2016	N001	18 -	137			#		
pH	s.u.	02/08/2016	N001	18 -	7.12			#		
Specific Conductance	umhos/cm	02/08/2016	N001	18 -	1206			#		
Temperature	C	02/08/2016	N001	18 -	6.41			#		
Turbidity	NTU	02/08/2016	N001	18 -	1.21	>		#		
Uranium	mg/L	02/08/2016	0001	18 -	0.0089		J	#	0.000029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0786 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/08/2016	0001	28 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	02/08/2016	N001	28 -	140			#		
pH	s.u.	02/08/2016	N001	28 -	7.3			#		
Specific Conductance	umhos/cm	02/08/2016	N001	28 -	1210			#		
Temperature	C	02/08/2016	N001	28 -	7.05			#		
Turbidity	NTU	02/08/2016	N001	28 -	0.66	>		#		
Uranium	mg/L	02/08/2016	0001	28 -	0.008		J	#	0.000029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0787 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/08/2016	0001	36 -	820		J	#	2.5	
Oxidation Reduction Potential	mV	02/08/2016	N001	36 -	251			#		
pH	s.u.	02/08/2016	N001	36 -	6.95			#		
Specific Conductance	umhos/cm	02/08/2016	N001	36 -	42738			#		
Temperature	C	02/08/2016	N001	36 -	9.26			#		
Turbidity	NTU	02/08/2016	N001	36 -	0.8			#		
Uranium	mg/L	02/08/2016	0001	36 -	2		J	#	0.00029	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: AMM-2 WELL East of pile along road.

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/11/2016	0001	48 -	620		J	#	2.5	
Oxidation Reduction Potential	mV	02/11/2016	N001	48 -	143			#		
pH	s.u.	02/11/2016	N001	48 -	7.13			#		
Specific Conductance	umhos/cm	02/11/2016	N001	48 -	18080			#		
Temperature	C	02/11/2016	N001	48 -	15.83			#		
Turbidity	NTU	02/11/2016	N001	48 -	8.14	>		#		
Uranium	mg/L	02/11/2016	0001	48 -	1.9		J	#	0.00029	

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: SMI-PZ1S WELL Baseline Area

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/12/2016	0001	18 -	230		J	#	0.1	
Ammonia Total as N	mg/L	02/12/2016	0002	18 -	230		J	#	0.1	
Oxidation Reduction Potential	mV	02/12/2016	N001	18 -	216			#		
pH	s.u.	02/12/2016	N001	18 -	7.08			#		
Specific Conductance	umhos/cm	02/12/2016	N001	18 -	11591			#		
Temperature	C	02/12/2016	N001	18 -	13.16			#		
Turbidity	NTU	02/12/2016	N001	18 -	7.37	>		#		
Uranium	mg/L	02/12/2016	0001	18 -	1.4		J	#	0.00029	
Uranium	mg/L	02/12/2016	0002	18 -	1.4		J	#	0.00029	

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- L Less than 3 bore volumes purged prior to sampling.
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9. J Estimated value.
- Q Qualitative result due to sampling technique.
- R Unusable result.
- X Location is undefined.

QA QUALIFIER:# Validated according to quality assurance guidelines.

Appendix A. February 2016 CF4 and Tree Plot Sampling Event (continued)

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 9/15/2016						
Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
682	O	3970.18	2/11/2016	13.66	3956.52	
683	O	3970.73	2/11/2016	14.09	3956.64	
684	O	3970.22	2/12/2016	14.05	3956.17	
732	O	3968.99	2/12/2016	12.38	3956.61	
733	O	3964.45	2/12/2016	11.94	3952.51	
780	O	3968.45	2/2/2016	15.05	3953.40	
781	O	3968.56	2/2/2016	14.85	3953.71	
782	O	3968.46	2/2/2016	15.06	3953.40	
783	O	3966.16	2/11/2016	13.31	3952.85	
784	O	3968.73	2/8/2016	15.96	3952.77	
785	O	3969.24	2/8/2016	15.64	3953.60	
786	O	3968.14	2/8/2016	14.99	3953.15	
787	O	3968.43	2/8/2016	15.15	3953.28	
AMM-2	O	3964.09	2/11/2016	9.73	3954.36	
SMI-PZ1S	O	3964.13	2/12/2016	9.70	3954.43	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Appendix A. July through November 2015 Crescent Junction Sampling Event (continued)

Trip Report



Date: September 1, 2016
To: Ken Pill
From: James Ritchey
Subject: February 2016 CF4 and Tree Plot Sampling Event
Site: Moab – CF4 and Tree Plot Sampling Event – February 2016
Date of Sampling Event: February 2 –12, 2016
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1602082.
Sample Shipment: Samples coolers were shipped overnight UPS to ALS Laboratory from Moab, Utah, on February 16 of 2015 (Tracking numbers 1Z5W1Y510191340405).

February 2016 Configuration 4 Sampling

Number of Locations Sampled: Eight observation wells (0780, 0781, 0782, 0783, 0784, 0785, 0786, and 0787) were sampled during the February 2016 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Sample Depth (ft bgs)	Ammonia Probe Result (mg/L)
0780	02/02/2016	15:15	15.05	28	NA
0781	02/02/2016	14:40	14.85	46	NA
0782	02/02/2016	15:00	15.06	33	NA
0783	02/11/2016	14:15	13.31	18	2.37
0784	02/08/2016	14:30	15.96	18	<1
0785	02/08/2016	13:40	15.64	18	<1
0786	02/08/2016	13:50	14.99	28	<1
0787	02/08/2016	14:05	15.15	36	NA

Appendix A. July through November 2015 Crescent Junction Sampling Event (*continued*)

Trip Report

February 2016 Tree Plot Sampling

Number of Locations Sampled: Seven observations wells (0682, 0683, 0684, 0732, 0733, AMM-2, and SMI-PZ1S) and one duplicate were sampled during the September 2015 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated matrix
2000	SMI-PZ1S	Duplicate from 18 ft bgs	Ground Water

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Pump Intake Depth (ft bgs)	Ammonia Probe Result (mg/L)
0682	02/11/2016	15:35	13.66	28	288
0683	02/11/2016	15:20	14.09	28	362
0684	02/12/2016	10:55	14.05	18	206
0732	02/12/2016	11:15	12.38	18	214
0733	02/12/2016	11:30	11.94	18	188
AMM-2	02/11/2016	14:55	9.73	48	625
SMI-PZ1S	02/12/2016	11:50	9.70	18	223

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: According to the USGS Cisco Gaging Station (Station No. 09180500), the mean daily Colorado River flow during this sampling event is provided below:

Appendix A. July through November 2015 Crescent Junction Sampling Event (continued)

Trip Report

Date	Daily Mean Flow (cfs)
2/2/2016	3,800
2/3/2016	3,590
2/4/2016	3,470
2/5/2016	3,340
2/6/2016	3,360
2/7/2016	3,490
2/8/2016	3,640
2/9/2016	3,580
2/10/2016	3,640
2/11/2016	3,530
2/12/2016	3,560

Corrective Action Required/Taken: None.

Appendix B.
February 2016 Crescent Junction Sampling Event

Water Sampling Field Activities Verification
Water Quality Data
Water Level Data
Trip Report

Appendix B. February 2016 Crescent Junction Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	February 2016 Crescent Junction Sampling Event/1602083	Date(s) of Water Sampling	February 10-11, 2016
Date(s) of Verification	April 19, 2016	Name of Verifier	Ken Pill

	Response (Yes, No, NA)	Comments
1. Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
List other documents, standard operating procedures, instructions.	NA	
2. Were the sampling locations specified in the planning documents sampled?	Yes	
3. Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
4. Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
Did the operational checks meet criteria?	Yes	
5. Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
6. Was the category of the well documented?	Yes	
7. Were the following conditions met when purging a Category I well:		
Was one pump/tubing volume purged before sampling?	Yes	
Did the water level stabilize before sampling?	Yes	
Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes	
Was the flow rate less than 500 milliliters per minute?	Yes	
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 milliliters per minute?	NA	
Was one pump/tubing volume removed before sampling?	NA	
9. Were duplicates taken at a frequency of one per 20 samples?	No	Only 1 sample collected

Appendix B. February 2016 Crescent Junction Sampling Event (continued)

Water Sampling Field Activities Verification Event (continued)

Sampling Event/RIN	February 2016 Crescent Junction Sampling Event/1602083	Date(s) of Water Sampling	February 10-11, 2016
Date(s) of Verification	April 19, 2016	Name of Verifier	Ken Pill
	Response (Yes, No, NA)	Comments	
10. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.	
11. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA		
12. Were quality-control samples assigned a fictitious site identification number?	Yes		
Was the true identity of the samples recorded on the quality assurance sample log?	Yes		
13. Were samples collected in the containers specified?	Yes		
14. Were samples filtered and preserved as specified?	Yes		
15. Were the number and types of samples collected as specified?	NA		
16. Were COC records completed, and was sample custody maintained?	Yes		
17. Are field data sheets signed and dated by both team members?	Yes		
18. Was all other pertinent information documented on the field data sheets?	NA		
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes		
20. Were water levels measured at the locations specified in the planning documents?	NA		

Appendix B. February 2016 Crescent Junction Sampling Event (continued)

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site

REPORT DATE: 9/13/2016

Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	02/10/2016	0001	68 -	16		J	#	0.1	
Arsenic	mg/L	02/10/2016	0001	68 -	0.0039	U	J	#	0.0039	
Barium	mg/L	02/10/2016	0001	68 -	0.014	J	J	#	0.00019	
BORON	ug/L	02/10/2016	0001	68 -	1100		J	#	3.1	
Bromide	mg/L	02/10/2016	0001	68 -	10	U	J	#	10	
Cadmium	mg/L	02/10/2016	0001	68 -	0.00033	U	J	#	0.00033	
Calcium	mg/L	02/10/2016	0001	68 -	270		J	#	0.012	
Chloride	mg/L	02/10/2016	0001	68 -	3300		J	#	50	
Chromium	mg/L	02/10/2016	0001	68 -	0.017		J	#	0.00051	
Copper	mg/L	02/10/2016	0001	68 -	0.0034	J	J	#	0.00097	
Fluoride	mg/L	02/10/2016	0001	68 -	5	U	J	#	5	
Iron	mg/L	02/10/2016	0001	68 -	0.0095	J	J	#	0.0049	
Lead	mg/L	02/10/2016	0001	68 -	0.0013	U	J	#	0.0013	
Magnesium	mg/L	02/10/2016	0001	68 -	1000		J	#	0.13	
Manganese	mg/L	02/10/2016	0001	68 -	0.35		J	#	0.00011	
MOLYBDENUM	ug/L	02/10/2016	0001	68 -	19		J	#	1.1	

Appendix B. February 2016 Crescent Junction Sampling Event *(continued)*

Water Quality Data *(continued)*

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site

REPORT DATE: 9/13/2016

Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Nitrate + Nitrite as Nitrogen	mg/L	02/10/2016	0001	68 -	920		J	#	10	
Nitrate as NO3	mg/L	02/10/2016	0001	68 -	990		J	#	50	
Nitrite as Nitrogen	mg/L	02/10/2016	0001	68 -	5	U	J	#	5	
Oxidation Reduction Potential	mV	02/10/2016	N001	68 -	218		J	#		
pH	s.u.	02/10/2016	N001	68 -	7.17		J	#		
Potassium	mg/L	02/10/2016	0001	68 -	64		J	#	0.11	
Selenium	mg/L	02/10/2016	0001	68 -	4.9		J	#	0.0027	
Sodium	mg/L	02/10/2016	0001	68 -	9600		J	#	0.66	
Specific Conductance	umhos/cm	02/10/2016	N001	68 -	39690		J	#		
Sulfate	mg/L	02/10/2016	0001	68 -	21000		J	#	250	
Temperature	C	02/10/2016	N001	68 -	13.1		J	#		
Total Dissolved Solids	mg/L	02/10/2016	0001	68 -	40000		J	#	1000	
Total Organic Carbon	mg/L	02/10/2016	N001	68 -	15		J	#	1	
Turbidity	NTU	02/10/2016	N001	68 -	8.66		J	#		
Uranium	mg/L	02/10/2016	0001	68 -	0.033		J	#	0.000029	

Appendix B. February 2016 Crescent Junction Sampling Event (*continued*)

Water Quality Data (*continued*)

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

* Replicate analysis not within control limits.
> Result above upper detection limit.
A TIC is a suspected aldol-condensation product.
B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
C Pesticide result confirmed by GC-MS.
D Analyte determined in diluted sample.
E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H Holding time expired, value suspect.
I Increased detection limit due to required dilution.
J Estimated
N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U Analytical result below detection limit.
W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F Low flow sampling method used. G Possible grout contamination, pH > 9. J Estimated value.
L Less than 3 bore volumes purged prior to sampling. Q Qualitative result due to sampling technique. R Unusable result.
U Parameter analyzed for but was not detected. X Location is undefined.

QA QUALIFIER:

Validated according to quality assurance guidelines.

Appendix B. February 2016 Crescent Junction Sampling Event (*continued*)

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 9/28/2015						
Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
0205	O	4949.0	02/10/2016	54.30	4894.70	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Appendix B. February 2016 Crescent Junction Sampling Event (continued)

Trip Report



Date: September 14, 2016
To: Ken Pill
From: James Ritchey
Subject: February 2016 CJ Sampling Event
Site: Crescent Junction – February 2016
Date of Sampling Event: February 9 – 10, 2016
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1602083.
Sample Shipment: Sample coolers were shipped overnight UPS to ALS Laboratory from Moab, Utah, on February 10, of 2016 (Tracking numbers 1Z5W1Y510192849196 and 1Z5W1Y510393756389).

Number of Locations Sampled: A total of three samples were collected at two different locations (Well 0205 and CJ Tailings) during the July 2015 CJ sampling event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information: Well 0205 sample was collected using a dedicated submersible pump with dedicated tubing. The table below provides additional information:

Location	Date	Depth to Water (ft btoc)	Sample Depth (ft bgs)	Comment
0205	2/10/2016	54.30	68	Yellow color

Tailings Batch Test Information: Two soils samples were collected of tailings from the Phase 2 disposal cell for nitrate. The samples were collected west of the standpipe on the slope of the cell where tailings had been place some time ago. The table below provides additional information:

Location	Date	Comments
CJ Tailings (1)	2/9/2016	Primary sample.
CJ Tailings (2)	2/9/2016	Duplicate.

Appendix B. February 2016 Crescent Junction Sampling Event (*continued*)

Trip Report

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: None.

Corrective Action Required/Taken: None.

Appendix C.
April 2016 Crescent Junction Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix C. April 2016 Crescent Junction Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	April 2016 Crescent Junction Sampling Event/1604084	Date(s) of Water Sampling	April 26, 2015
Date(s) of Verification	June 8, 2016	Name of Verifier	Ken Pill
		Response (Yes, No, NA)	Comments
1.	Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes	
2.	List other documents, standard operating procedures, instructions.	NA	
3.	Were the sampling locations specified in the planning documents sampled?	Yes	
4.	Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes	
5.	Was an operational check of the field equipment conducted in accordance with the SAP?	Yes	
6.	Did the operational checks meet criteria?	Yes	
7.	Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.
8.	Was the category of the well documented?	Yes	
9.	Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling? Did the water level stabilize before sampling? Did pH, specific conductance, and turbidity measurements stabilize before sampling? Was the flow rate less than 500 milliliters per minute?	Yes Yes Yes Yes	
	If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	
10.	Were the following conditions met when purging a Category II well: Was the flow rate less than 500 milliliters per minute? Was one pump/tubing volume removed before sampling?	Yes Yes	
11.	Were duplicates taken at a frequency of one per 20 samples?	No	Only 1 sample was collected.

Appendix C. April 2016 Crescent Junction Sampling Event (continued)
Water Sampling Field Activities Verification (continued)

Sampling Event/RIN	April 2016 Crescent Junction Sampling Event/1604084	Date(s) of Water Sampling	April 26, 2015
Date(s) of Verification	June 8, 2016	Name of Verifier	Ken Pill
	Response (Yes, No, NA)	Comments	
12. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.	
13. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA		
14. Were quality-control samples assigned a fictitious site identification number?	Yes		
Was the true identity of the samples recorded on the quality assurance sample log?	Yes		
15. Were samples collected in the containers specified?	Yes		
16. Were samples filtered and preserved as specified?	Yes		
17. Were the number and types of samples collected as specified?	NA		
18. Were COC records completed, and was sample custody maintained?	Yes		
19. Are field data sheets signed and dated by both team members?	Yes		
20. Was all other pertinent information documented on the field data sheets?	NA		
21. Was the presence or absence of ice in the cooler documented at every sample location?	Yes		
22. Were water levels measured at the locations specified in the planning documents?	Yes		

Appendix C. April 2016 Crescent Junction Sampling Event *(continued)*

Minimums and Maximums Report *(continued)*

Data Validation Minimums and Maximums Report - No Field Parameters

Laboratory: ALS

RIN: 1604084

Comparison: All Historical Data

Report Date: 9/13/2016

Site Code	Location Code	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Count	
				Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	N	N Below Detect		
CRJ01	0205	04/26/2016	Barium	0.012	J	3.5			0.014	J	6	0	
CRJ01	0205	04/26/2016	Potassium	53		68			57		6	0	
CRJ01	0205	04/26/2016	Total Dissolved Solids	24000	*	48000			40000		5	0	

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

Analyte concentrations presented in blue text represent the historical minimum or maximum value exceeded by the concentration presented in red, which is associated with this current sampling event.

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- L Less than 3 bore volumes purged prior to sampling.
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9. J Estimated value.
- Q Qualitative result due to sampling technique. R Unusable result.
- X Location is undefined.

Appendix C. April 2016 Crescent Junction Sampling Event (continued)
Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site
REPORT DATE: 9/13/2016
Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Ammonia Total as N	mg/L	04/26/2016	0001	68	-	13		J	#	1	
Arsenic	mg/L	04/26/2016	0001	68	-	0.039	U	J	#	0.039	
Barium	mg/L	04/26/2016	0001	68	-	0.012	J	J	#	0.0019	
BICARBONATE AS CaCO3	mg/L	04/26/2016	0001	68	-	990		J	#	20	
BORON	ug/L	04/26/2016	0001	68	-	1300		J	#	31	
Bromide	mg/L	04/26/2016	0001	68	-	20	U	J	#	20	
Cadmium	mg/L	04/26/2016	0001	68	-	0.0033	U	J	#	0.0033	
Calcium	mg/L	04/26/2016	0001	68	-	350		J	#	0.12	
CARBONATE AS CaCO3	mg/L	04/26/2016	0001	68	-	20	U	J	#	20	
Chloride	mg/L	04/26/2016	0001	68	-	3400		J	#	200	
Chromium	mg/L	04/26/2016	0001	68	-	0.0051	U	J	#	0.0051	
Copper	mg/L	04/26/2016	0001	68	-	0.0097	U	J	#	0.0097	
Fluoride	mg/L	04/26/2016	0001	68	-	10	U	J	#	10	
Iron	mg/L	04/26/2016	0001	68	-	0.049	U	J	#	0.049	
Lead	mg/L	04/26/2016	0001	68	-	0.013	U	J	#	0.013	
Magnesium	mg/L	04/26/2016	0001	68	-	1000		J	#	0.13	
Manganese	mg/L	04/26/2016	0001	68	-	0.47		J	#	0.0011	

Appendix C. April 2016 Crescent Junction Sampling Event (continued)
Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE CRJ01, Crescent Junction Site

REPORT DATE: 9/13/2016

Location: 0205 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
MOLYBDENUM	ug/L	04/26/2016	0001	68 -	11	U	J	#	11	
Nitrate + Nitrite as Nitrogen	mg/L	04/26/2016	0001	68 -	930		J	#	10	
Potassium	mg/L	04/26/2016	0001	68 -	53		J	#	1.1	
Selenium	mg/L	04/26/2016	0001	68 -	4.4		J	#	0.027	
Sodium	mg/L	04/26/2016	0001	68 -	10000		J	#	0.66	
Sulfate	mg/L	04/26/2016	0001	68 -	21000		J	#	1000	
TOTAL ALKALINITY AS CaCO3	mg/L	04/26/2016	0001	68 -	990		J	#	20	
Total Dissolved Solids	mg/L	04/26/2016	0001	68 -	24000	*	J	#	1000	
Uranium	mg/L	04/26/2016	0001	68 -	0.033		J	#	0.000012	

BLS = below land surface; µmhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- L Less than 3 bore volumes purged prior to sampling.
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9. J Estimated value.
- Q Qualitative result due to sampling technique. R Unusable result.
- X Location is undefined.

QA QUALIFIER:

- # Validated according to quality assurance guidelines.

Appendix C. April 2016 Crescent Junction Sampling Event *(continued)*

Water Level Data

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site

REPORT DATE: 9/28/2015

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
0205	O	4949.0	04/26/2016	53.10	4895.90	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Appendix C. April 2016 Crescent Junction Sampling Event (continued)
Trip Report



Date: September 14, 2016
To: Ken Pill
From: James Ritchey
Subject: April 2016 CJ Sampling Event

Site: Crescent Junction – July 2016

Date of Sampling Event: April 26, 2016

Team Members: E. Moran, K. Pill, and J. Ritchey

RIN Number Assigned: The sample was assigned to RIN 1604084.

Sample Shipment Sample cooler was shipped overnight UPS to ALS Laboratory from Moab, Utah, on May 9, 2016 (Tracking number: 1Z5W1Y510195205929).

Number of Locations Sampled: One sample was collected from well 0205 during the April 2016 CJ sampling event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information: Well 0205 sample was collected using a dedicated submersible pump with dedicated tubing. The table below provides additional information:

Location	Date	Depth to Water (ft btoc)	Sample Depth (ft bgs)	Comment
0205	4/26/2016	53.10	68	Yellow color

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: None.

Corrective Action Required/Taken: None.

Appendix D.
May 2016 CF4 and Tree Plot Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Water Quality Data
Water Level Data
Trip Report

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Sampling Field Activities

Appendix D. May 2016 CF4 and Tree Plot Sampling Event

Water Sampling Field Activities Verification

Sampling Event/RIN	<u>May 2016 CF4 and Tree Plot Sampling Event/1605085</u>	Date(s) of Water Sampling	<u>May 2-5, 2016</u>
Date(s) of Verification	<u>July 20, 2016</u>	Name of Verifier	<u>Ken Pill</u>

	Response (Yes, No, NA)	Comments
21. Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	<u>Yes</u>	
List other documents, standard operating procedures, instructions.	<u>NA</u>	
22. Were the sampling locations specified in the planning documents sampled?	<u>Yes</u>	
23. Was a pre-trip calibration conducted as specified in the aforementioned documents?	<u>Yes</u>	
24. Was an operational check of the field equipment conducted in accordance with the SAP?	<u>Yes</u>	
Did the operational checks meet criteria?	<u>Yes</u>	
25. Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	<u>Yes</u>	<u>Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.</u>
26. Was the category of the well documented?	<u>Yes</u>	
27. Were the following conditions met when purging a Category I well:		
Was one pump/tubing volume purged before sampling?	<u>Yes</u>	
Did the water level stabilize before sampling?	<u>Yes</u>	
Did pH, specific conductance, and turbidity measurements stabilize before sampling?	<u>Yes</u>	
Was the flow rate less than 500 milliliters per minute?	<u>Yes</u>	
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	<u>NA</u>	
28. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 milliliters per minute?	<u>NA</u>	
Was one pump/tubing volume removed before sampling?	<u>NA</u>	
29. Were duplicates taken at a frequency of one per 20 samples?	<u>Yes</u>	<u>One duplicate was collected for 15 samples.</u>

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Sampling Field Activities (continued)

Sampling Event/RIN	May 2016 CF4 and Tree Plot Sampling Event/1605085	Date(s) of Water Sampling	May 2-5, 2016
Date(s) of Verification	July 20, 2016	Name of Verifier	Ken Pill
	Response (Yes, No, NA)	Comments	
30. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	All samples were collected using dedicated equipment.	
31. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA		
32. Were quality-control samples assigned a fictitious site identification number?	Yes		
Was the true identity of the samples recorded on the quality assurance sample log?	Yes		
33. Were samples collected in the containers specified?	Yes		
34. Were samples filtered and preserved as specified?	Yes		
35. Were the number and types of samples collected as specified?	NA		
36. Were COC records completed, and was sample custody maintained?	Yes		
37. Are field data sheets signed and dated by both team members?	Yes		
38. Was all other pertinent information documented on the field data sheets?	NA		
39. Was the presence or absence of ice in the cooler documented at every sample location?	Yes		
40. Were water levels measured at the locations specified in the planning documents?	Yes		

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters

Laboratory: ALS

RIN: 1605085

Comparison: All Historical Data

Report Date: 9/5/2016

Site Code	Location Code	Sample Date	Analyte	Current Result	Current Qualifiers		Historical Maximum Result	Historical Maximum Qualifiers		Historical Minimum Result	Historical Minimum Qualifiers		Count	
					Lab	Data		Lab	Data		Lab	Data	N	N Below Detect
MOA01	0732	05/03/2016	Ammonia Total as N	260			230			0.1	U	J	17	1
MOA01	0733	05/05/2016	Ammonia Total as N	240			200			0.19		J	19	0
MOA01	0781	05/02/2016	Ammonia Total as N	2700			2300			25			34	0
MOA01	0787	05/03/2016	Ammonia Total as N	2900			910			21			42	0

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- L Less than 3 bore volumes purged prior to sampling.
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9. J Estimated value.
- Q Qualitative result due to sampling technique.
- R Unusable result.
- X Location is undefined.

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 9/5/2016
Location: 0682 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers		Detection Limit	Uncertainty
						Lab	Data QA		
Ammonia Total as N	mg/L	05/03/2016	0001	28 -	350	J	#	30	
Oxidation Reduction Potential	mV	05/03/2016	N001	28 -	92		#		
pH	s.u.	05/03/2016	N001	28 -	6.59		#		
Specific Conductance	umhos/cm	05/03/2016	N001	28 -	16513		#		
Temperature	C	05/03/2016	N001	28 -	15.59		#		
Turbidity	NTU	05/03/2016	N001	28 -	1.22		#		
Uranium	mg/L	05/03/2016	0001	28 -	1.8	J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site
REPORT DATE: 9/5/2016
Location: 0683 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers		Detection Limit	Uncertainty
						Lab	Data QA		
Ammonia Total as N	mg/L	05/03/2016	0001	28 -	400	J	#	30	
Oxidation Reduction Potential	mV	05/03/2016	N001	28 -	92		#		
pH	s.u.	05/03/2016	N001	28 -	6.61		#		
Specific Conductance	umhos/cm	05/03/2016	N001	28 -	16457		#		
Temperature	C	05/03/2016	N001	28 -	16.14		#		
Turbidity	NTU	05/03/2016	N001	28 -	2.49		#		
Uranium	mg/L	05/03/2016	0001	28 -	1.7	J	#	0.00012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0684 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/05/2016	0001	18 -	290		J	#	30	
Oxidation Reduction Potential	mV	05/05/2016	N001	18 -	134			#		
pH	s.u.	05/05/2016	N001	18 -	6.57			#		
Specific Conductance	umhos/cm	05/05/2016	N001	18 -	15976			#		
Temperature	C	05/05/2016	N001	18 -	15.69			#		
Turbidity	NTU	05/05/2016	N001	18 -	3.85			#		
Uranium	mg/L	05/05/2016	0001	18 -	1.7		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0732 WELL Infiltration Trench

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/03/2016	0001	18 -	260		J	#	30	
Oxidation Reduction Potential	mV	05/03/2016	N001	18 -	87			#		
pH	s.u.	05/03/2016	N001	18 -	6.59			#		
Specific Conductance	umhos/cm	05/03/2016	N001	18 -	15334			#		
Temperature	C	05/03/2016	N001	18 -	15.49			#		
Turbidity	NTU	05/03/2016	N001	18 -	0.91			#		
Uranium	mg/L	05/03/2016	0001	18 -	1.4		J	#	0.00012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0733 WELL Infiltration Trench

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/05/2016	0001	18 -	240		J	#	30	
Oxidation Reduction Potential	mV	05/05/2016	N001	18 -	124			#		
pH	s.u.	05/05/2016	N001	18 -	6.61			#		
Specific Conductance	umhos/cm	05/05/2016	N001	18 -	13945			#		
Temperature	C	05/05/2016	N001	18 -	15.19			#		
Turbidity	NTU	05/05/2016	N001	18 -	9.84			#		
Uranium	mg/L	05/05/2016	0001	18 -	1.6		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0780 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/02/2016	0001	28 -	4.5		J	#	0.1	
Oxidation Reduction Potential	mV	05/02/2016	N001	28 -	38			#		
pH	s.u.	05/02/2016	N001	28 -	7.6			#		
Specific Conductance	umhos/cm	05/02/2016	N001	28 -	3430			#		
Temperature	C	05/02/2016	N001	28 -	12			#		
Turbidity	NTU	05/02/2016	N001	28 -	3.05			#		
Uranium	mg/L	05/02/2016	0001	28 -	0.14		J	#	0.000012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0781 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/02/2016	0001	48 -	2700		J	#	200	
Oxidation Reduction Potential	mV	05/02/2016	N001	48 -	155			#		
pH	s.u.	05/02/2016	N001	48 -	6.45			#		
Specific Conductance	umhos/cm	05/02/2016	N001	48 -	96557			#		
Temperature	C	05/02/2016	N001	48 -	14.84			#		
Turbidity	NTU	05/02/2016	N001	48 -	0.86			#		
Uranium	mg/L	05/02/2016	0001	48 -	1.4		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0782 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/02/2016	0001	33 -	360		J	#	30	
Oxidation Reduction Potential	mV	05/02/2016	N001	33 -	107			#		
pH	s.u.	05/02/2016	N001	33 -	7.03			#		
Specific Conductance	umhos/cm	05/02/2016	N001	33 -	20503			#		
Temperature	C	05/02/2016	N001	33 -	12.93			#		
Turbidity	NTU	05/02/2016	N001	33 -	1.82			#		
Uranium	mg/L	05/02/2016	0001	33 -	2.3		J	#	0.00012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0783 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/03/2016	0001	18 -	1.4		J	#	0.1	
Oxidation Reduction Potential	mV	05/03/2016	N001	18 -	76			#		
pH	s.u.	05/03/2016	N001	18 -	7.17			#		
Specific Conductance	umhos/cm	05/03/2016	N001	18 -	1359			#		
Temperature	C	05/03/2016	N001	18 -	11.5			#		
Turbidity	NTU	05/03/2016	N001	18 -	2.49			#		
Uranium	mg/L	05/03/2016	0001	18 -	0.092		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0784 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/03/2016	0001	18 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/03/2016	N001	18 -	56			#		
pH	s.u.	05/03/2016	N001	18 -	7.4			#		
Specific Conductance	umhos/cm	05/03/2016	N001	18 -	970			#		
Temperature	C	05/03/2016	N001	18 -	13.58			#		
Turbidity	NTU	05/03/2016	N001	18 -	1.27			#		
Uranium	mg/L	05/03/2016	0001	18 -	0.011		J	#	0.000012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0785 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/02/2016	0001	18 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	05/02/2016	N001	18 -	33			#		
pH	s.u.	05/02/2016	N001	18 -	7.73			#		
Specific Conductance	umhos/cm	05/02/2016	N001	18 -	985			#		
Temperature	C	05/02/2016	N001	18 -	12.19			#		
Turbidity	NTU	05/02/2016	N001	18 -	1.71			#		
Uranium	mg/L	05/02/2016	0001	18 -	0.0092		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0786 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/03/2016	0001	28 -	30		J	#	2.5	
Oxidation Reduction Potential	mV	05/03/2016	N001	28 -	160			#		
pH	s.u.	05/03/2016	N001	28 -	6.8			#		
Specific Conductance	umhos/cm	05/03/2016	N001	28 -	9112			#		
Temperature	C	05/03/2016	N001	28 -	12.31			#		
Turbidity	NTU	05/03/2016	N001	28 -	0.47			#		
Uranium	mg/L	05/03/2016	0001	28 -	0.69		J	#	0.000012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0787 WELL Configuration 4

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/03/2016	0001	36 -	2900		J	#	200	
Oxidation Reduction Potential	mV	05/03/2016	N001	36 -	208			#		
pH	s.u.	05/03/2016	N001	36 -	6.66			#		
Specific Conductance	umhos/cm	05/03/2016	N001	36 -	93158			#		
Temperature	C	05/03/2016	N001	36 -	13.76			#		
Turbidity	NTU	05/03/2016	N001	36 -	0.76			#		
Uranium	mg/L	05/03/2016	0001	36 -	1.5		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: AMM-2 WELL East of pile along road.

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/05/2016	0001	48 -	490		J	#	80	
Oxidation Reduction Potential	mV	05/05/2016	N001	48 -	152			#		
pH	s.u.	05/05/2016	N001	48 -	6.72			#		
Specific Conductance	umhos/cm	05/05/2016	N001	48 -	20080			#		
Temperature	C	05/05/2016	N001	48 -	16.16			#		
Turbidity	NTU	05/05/2016	N001	48 -	4.43			#		
Uranium	mg/L	05/05/2016	0001	48 -	2		J	#	0.00012	

Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: SMI-PZ1S WELL Baseline Area

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	05/05/2016	0001	18 -	210	J	#		10	
Ammonia Total as N	mg/L	05/05/2016	0002	18 -	210	J	#		30	
Oxidation Reduction Potential	mV	05/05/2016	N001	18 -	98		#			
pH	s.u.	05/05/2016	N001	18 -	6.79		#			
Specific Conductance	umhos/cm	05/05/2016	N001	18 -	12603		#			
Temperature	C	05/05/2016	N001	18 -	13.58		#			
Turbidity	NTU	05/05/2016	N001	18 -	14.2		#			
Uranium	mg/L	05/05/2016	0001	18 -	1.6	J	#		0.00012	
Uranium	mg/L	05/05/2016	0002	18 -	1.6	J	#		0.00012	

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used. G Possible grout contamination, pH > 9. J Estimated value.
- L Less than 3 bore volumes purged prior to sampling. Q Qualitative result due to sampling technique. R Unusable result.
- U Parameter analyzed for but was not detected. X Location is undefined.

QA QUALIFIER: # Validated according to quality assurance guidelines.

**Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)
Water Level Data**

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 3/15/2015						
Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
682	O	3970.18	10/26/2015	13.44	3956.74	
683	O	3970.73	10/26/2015	13.92	3956.81	
684	O	3970.22	10/26/2015	13.83	3956.39	
732	O	3968.99	10/26/2015	12.19	3956.8	
733	O	3964.45	10/26/2015	11.75	3952.7	
780	O	3968.45	11/2/2015	14.67	3953.78	
781	O	3968.56	11/2/2015	14.68	3953.88	
782	O	3968.46	11/2/2015	14.69	3953.77	
783	O	3966.16	11/4/2015	13.12	3953.04	
784	O	3968.73	11/2/2015	15.6	3953.13	
785	O	3969.24	11/4/2015	15.55	3953.69	
786	O	3968.14	11/2/2015	14.66	3953.48	
787	O	3968.43	11/2/2015	14.8	3953.63	
AMM-2	O	3964.09	10/21/2015	9.83	3954.26	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

**Appendix D. May 2016 CF4 and Tree Plot Sampling Event
Trip Report**



Date: September 1, 2016
To: Ken Pill
From: James Ritchey
Subject: May 2016 CF4 and Tree Plot Sampling Event
Site: Moab – CF4 and Tree Plot Sampling Event – May 2016
Date of Sampling Event: May 2 –5, 2016
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1605085.
Sample Shipment: Samples coolers were shipped overnight UPS to ALS Laboratory from Moab, Utah on May 9 of 2015 (Tracking numbers 1Z5W1Y510195205929).

May 2016 Configuration 4 Sampling

Number of Locations Sampled: Eight observation wells (0780, 0781, 0782, 0783, 0784, 0785, 0786, and 0787) were sampled during the May 2016 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: None.

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Sample Depth (ft bgs)
0780	05/02/2016	14:30	14.48	28
0781	05/02/2016	14:00	14.05	48
0782	05/02/2016	14:20	14.44	33
0783	05/03/2016	10:35	12.50	18
0784	05/03/2016	10:20	15.10	18
0785	05/02/2016	14:50	15.10	18
0786	05/03/2016	9:45	14.44	28
0787	05/03/2016	10:00	14.55	36

**Appendix D. May 2016 CF4 and Tree Plot Sampling Event (continued)
Trip Report (continued)**

May 2016 Tree Plot Sampling

Number of Locations Sampled: Seven observations wells (0682, 0683, 0684, 0732, 0733, AMM-2, and SMI-PZ1S) and one duplicate were sampled during the May 2016 Sampling Event.

Locations Not Sampled: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated matrix
2000	SMI-PZ1S	Duplicate from 18 ft bgs	Ground Water

Location Specific Information – Observation Wells: All observation wells were sampled using micro-purge techniques with a peristaltic pump and dedicated pump-head and downhole tubing. Sample depths and water levels for each observation well are listed below.

Well No.	Date	Time	Depth to Water (ft btoc)	Pump Intake Depth (ft bgs)
0682	05/03/2016	14:20	12.95	28
0683	05/03/2016	14:45	13.37	28
0684	05/05/2016	10:20	13.34	18
0732	05/03/2016	15:05	11.65	18
0733	05/05/2016	10:40	11.20	18
AMM-2	05/05/2016	9:50	9.22	48
SMI-PZ1S	05/05/2016	11:30	9.00	18

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: According to the USGS Cisco Gaging Station (Station No. 09180500), the mean daily Colorado River flow during this sampling event is provided below:

Date	Daily Mean Flow (cfs)
5/2/2016	6,380
5/3/2016	6,070
5/4/2016	5,880
5/5/2016	6,140

Corrective Action Required/Taken: None.

Appendix E.
June/July 2016 Site-wide Sampling Event

Water Sampling Field Activities Verification
Minimums and Maximums Report
Blanks Report
Water Quality Data
Water Level Data
Trip Report

**Appendix E. June/July 2016 Site-wide Sampling Event
Water Sampling Field Activities Verification**

Sampling Event/RIN	June/July 2016 Site-wide Sampling Event/1606086	Date(s) of Water Sampling	June 3 through July 7, 2016
Date(s) of Verification	September 12, 2016	Name of Verifier	Ken Pill
	Response (Yes, No, NA)	Comments	
41. Is the Sampling Analysis Plan (SAP) the primary document directing field procedures?	Yes		
List other documents, standard operating procedures, instructions.	NA		
42. Were the sampling locations specified in the planning documents sampled?	Yes		
43. Was a pre-trip calibration conducted as specified in the aforementioned documents?	Yes		
44. Was an operational check of the field equipment conducted in accordance with the SAP?	Yes		
Did the operational checks meet criteria?	Yes		
45. Were the number and types (alkalinity, temperature, electrical conductivity, pH, turbidity, oxidation reduction potential) of field measurements taken as specified?	Yes	Field measurements for temperature, pH, turbidity, oxidation reduction potential, and conductivity were collected.	
46. Was the category of the well documented?	Yes		
47. Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged before sampling?	Yes		
Did the water level stabilize before sampling?	Yes		
Did pH, specific conductance, and turbidity measurements stabilize before sampling?	Yes		
Was the flow rate less than 500 milliliters per minute?	Yes		
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA		
48. Were the following conditions met when purging a Category II well: Was the flow rate less than 500 milliliters per minute?	NA		
Was one pump/tubing volume removed before sampling?	NA		
49. Were duplicates taken at a frequency of one per 20 samples?	Yes	Three duplicates were collected for 44 samples.	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Sampling Field Activities Verification (continued)

Sampling Event/RIN	June/July 2016 Site-wide Sampling Event/1606086	Date(s) of Water Sampling	June 3 through July 7, 2016
Date(s) of Verification	September 12, 2016	Name of Verifier	Ken Pill
	Response (Yes, No, NA)	Comments	
50. Were EBs taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	Yes	One equipment blank was collected for the eight surface water samples	
51. Were trip blanks prepared and included with each shipment of volatile organic compound samples?	NA		
52. Were quality-control samples assigned a fictitious site identification number?	Yes		
Was the true identity of the samples recorded on the quality assurance sample log?	Yes		
53. Were samples collected in the containers specified?	Yes		
54. Were samples filtered and preserved as specified?	Yes		
55. Were the number and types of samples collected as specified?	NA		
56. Were COC records completed, and was sample custody maintained?	Yes		
57. Are field data sheets signed and dated by both team members?	Yes		
58. Was all other pertinent information documented on the field data sheets?	NA		
59. Was the presence or absence of ice in the cooler documented at every sample location?	Yes		
60. Were water levels measured at the locations specified in the planning documents?	Yes		

Appendix E. June/July 2016 Site-wide Sampling Event *(continued)*

Minimums and Maximums Report

Data Validation Minimums and Maximums Report - No Field Parameters

Laboratory: ALS

RIN: 1606086

Comparison: All Historical Data

Report Date: 9/5/2016

Site Code	Location Code	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Count	
				Result	Qualifiers Lab Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect
MOA01	0411	06/28/2016	Ammonia Total as N	1.5		9.1			1.6			12	0
MOA01	0441	06/14/2016	Uranium	0.065		0.059			0.025			9	0
MOA01	0492	07/05/2016	Uranium	0.047		6		F	0.051			35	0
MOA01	SMI-PZ3S	06/29/2016	Ammonia Total as N	2.8		11.491		F	3			20	0
MOA01	SMI-PZ3S	06/29/2016	Uranium	0.95		3.24		F	0.99			21	0
MOA01	TP-23	06/07/2016	Uranium	2.7		4.1			2.8			11	0
MOA01	UPD-17	06/29/2016	Ammonia Total as N	320		300			100			8	0
MOA01	UPD-18	06/29/2016	Uranium	2		1.5			0.81			10	0
MOA01	UPD-22	06/03/2016	Ammonia Total as N	7.1		4.4			0.76			8	0
MOA01	UPD-23	06/30/2016	Uranium	0.49		0.9			0.63			7	0
MOA01	UPD-24	06/29/2016	Ammonia Total as N	0.8		2.9			0.93			10	0
MOA01	UPD-24	06/29/2016	Uranium	3.6		14			3.9			11	0

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Blanks Report

BLANKS REPORT

Laboratory: ALS

RIN: 1606086

Report Date: 9/5/2016

Site Code	Location ID	Sample Date	Sample ID	Units	Result	Qualifiers Lab Data	Detection Limit	Uncertainty	Sample Type
MOA01	0999	07/07/2016	0001	mg/L	.1	U	.1		E
MOA01	0999	07/07/2016	0001	mg/L	.00011		.000012		E

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- L Less than 3 bore volumes purged prior to sampling.
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9.
- Q Qualitative result due to sampling technique.
- X Location is undefined.
- J Estimated value.
- R Unusable result.

SAMPLE TYPES:

- E Equipment Blank.

Appendix E. June/July 2016 Site-wide Sampling Event *(continued)*

Water Quality Data

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0201 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/06/2016	0001	0 - 0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	07/06/2016	N001	0 - 0	99			#		
pH	s.u.	07/06/2016	N001	0 - 0	7.72			#		
Specific Conductance	umhos/cm	07/06/2016	N001	0 - 0	699			#		
Temperature	C	07/06/2016	N001	0 - 0	23.15			#		
Turbidity	NTU	07/06/2016	N001	0 - 0	999	>		#		
Uranium	mg/L	07/06/2016	0001	0 - 0	0.0028		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0218 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/30/2016	0001	0 - 0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/30/2016	N001	0 - 0	134			#		
pH	s.u.	06/30/2016	N001	0 - 0	7.94			#		
Specific Conductance	umhos/cm	06/30/2016	N001	0 - 0	537			#		
Temperature	C	06/30/2016	N001	0 - 0	22.47			#		
Turbidity	NTU	06/30/2016	N001	0 - 0	70.6			#		
Uranium	mg/L	06/30/2016	0001	0 - 0	0.002		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0226 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/05/2016	0001	0 - 0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	07/05/2016	N001	0 - 0	-55			#		
pH	s.u.	07/05/2016	N001	0 - 0	7.92			#		
Specific Conductance	umhos/cm	07/05/2016	N001	0 - 0	872			#		
Temperature	C	07/05/2016	N001	0 - 0	21.94			#		
Turbidity	NTU	07/05/2016	N001	0 - 0	999	>		#		
Uranium	mg/L	07/05/2016	0001	0 - 0	0.0025		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0403 WELL Configuration 1

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/08/2016	0001	18 -	73		J	#	0.1	
Oxidation Reduction Potential	mV	06/08/2016	N001	18 -	142			#		
pH	s.u.	06/08/2016	N001	18 -	7.34			#		
Specific Conductance	umhos/cm	06/08/2016	N001	18 -	3943			#		
Temperature	C	06/08/2016	N001	18 -	15.46			#		
Turbidity	NTU	06/08/2016	N001	18 -	1.85			#		
Uranium	mg/L	06/08/2016	0001	18 -	0.37		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0404 WELL Configuration 3

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/08/2016	0001	18 -	310		J	#	0.1	
Oxidation Reduction Potential	mV	06/08/2016	N001	18 -	188			#		
pH	s.u.	06/08/2016	N001	18 -	6.82			#		
Specific Conductance	umhos/cm	06/08/2016	N001	18 -	15888			#		
Temperature	C	06/08/2016	N001	18 -	15.64			#		
Turbidity	NTU	06/08/2016	N001	18 -	1.68			#		
Uranium	mg/L	06/08/2016	0001	18 -	1.7		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0410 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/28/2016	0001	23.5 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/28/2016	N001	23.5 -	155			#		
pH	s.u.	06/28/2016	N001	23.5 -	7.03			#		
Specific Conductance	umhos/cm	06/28/2016	N001	23.5 -	3465			#		
Temperature	C	06/28/2016	N001	23.5 -	21.66			#		
Turbidity	NTU	06/28/2016	N001	23.5 -	9.55			#		
Uranium	mg/L	06/28/2016	0001	23.5 -	0.45		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0411 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/28/2016	0001	8 -	1.5		J	#	0.1	
Oxidation Reduction Potential	mV	06/28/2016	N001	8 -	153			#		
pH	s.u.	06/28/2016	N001	8 -	7.3			#		
Specific Conductance	umhos/cm	06/28/2016	N001	8 -	5906			#		
Temperature	C	06/28/2016	N001	8 -	24.21			#		
Turbidity	NTU	06/28/2016	N001	8 -	34.6			#		
Uranium	mg/L	06/28/2016	0001	8 -	2.4		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0412 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/07/2016	0001	9.5 -	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	07/07/2016	0002	9.5 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	07/07/2016	N001	9.5 -	145			#		
pH	s.u.	07/07/2016	N001	9.5 -	7.75			#		
Specific Conductance	umhos/cm	07/07/2016	N001	9.5 -	1249			#		
Temperature	C	07/07/2016	N001	9.5 -	19.46			#		
Turbidity	NTU	07/07/2016	N001	9.5 -	249			#		
Uranium	mg/L	07/07/2016	0001	9.5 -	1.7		J	#	0.00012	
Uranium	mg/L	07/07/2016	0002	9.5 -	1.8		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0413 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	10.5 -	56		J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	10.5 -	-78			#		
pH	s.u.	06/03/2016	N001	10.5 -	7.86			#		
Specific Conductance	umhos/cm	06/03/2016	N001	10.5 -	6619			#		
Temperature	C	06/03/2016	N001	10.5 -	15.32			#		
Turbidity	NTU	06/03/2016	N001	10.5 -	1.7			#		
Uranium	mg/L	06/03/2016	0001	10.5 -	3.7		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0439 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/28/2016	0001	118 -	4.3		J	#	0.1	
Oxidation Reduction Potential	mV	06/28/2016	N001	118 -	125			#		
pH	s.u.	06/28/2016	N001	118 -	6.8			#		
Specific Conductance	umhos/cm	06/28/2016	N001	118 -	10458			#		
Temperature	C	06/28/2016	N001	118 -	17.63			#		
Turbidity	NTU	06/28/2016	N001	118 -	4.57			#		
Uranium	mg/L	06/28/2016	0001	118 -	1.3		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0440 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/28/2016	0001	117 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/28/2016	N001	117 -	139			#		
pH	s.u.	06/28/2016	N001	117 -	6.83			#		
Specific Conductance	umhos/cm	06/28/2016	N001	117 -	8564			#		
Temperature	C	06/28/2016	N001	117 -	20.62			#		
Turbidity	NTU	06/28/2016	N001	117 -	11.2			#		
Uranium	mg/L	06/28/2016	0001	117 -	0.033		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0441 WELL Queue/Support Area

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/14/2016	0001	117 -	0.1	U	J	#	0.1	
Ammonia Total as N	mg/L	06/14/2016	0002	117 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/14/2016	N001	117 -	170			#		
pH	s.u.	06/14/2016	N001	117 -	6.94			#		
Specific Conductance	umhos/cm	06/14/2016	N001	117 -	20867			#		
Temperature	C	06/14/2016	N001	117 -	20.11			#		
Turbidity	NTU	06/14/2016	N001	117 -	2.85			#		
Uranium	mg/L	06/14/2016	0001	117 -	0.065		J	#	0.000012	
Uranium	mg/L	06/14/2016	0002	117 -	0.057		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0444 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	116 -	1.9		J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	116 -	-224			#		
pH	s.u.	06/03/2016	N001	116 -	7.43			#		
Specific Conductance	umhos/cm	06/03/2016	N001	116 -	126840			#		
Temperature	C	06/03/2016	N001	116 -	18.7			#		
Turbidity	NTU	06/03/2016	N001	116 -	3.39			#		
Uranium	mg/L	06/03/2016	0001	116 -	0.015		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0453 WELL Contaminated Area

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/28/2016	0001	80 -	200		J	#	5	
Oxidation Reduction Potential	mV	06/28/2016	N001	80 -	108			#		
pH	s.u.	06/28/2016	N001	80 -	7.01			#		
Specific Conductance	umhos/cm	06/28/2016	N001	80 -	36191			#		
Temperature	C	06/28/2016	N001	80 -	19.94			#		
Turbidity	NTU	06/28/2016	N001	80 -	5.75			#		
Uranium	mg/L	06/28/2016	0001	80 -	0.78		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0454 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/07/2016	0001	13 -	170		J	#	0.1	
Oxidation Reduction Potential	mV	06/07/2016	N001	13 -	-285			#		
pH	s.u.	06/07/2016	N001	13 -	6.8			#		
Specific Conductance	umhos/cm	06/07/2016	N001	13 -	109551			#		
Temperature	C	06/07/2016	N001	13 -	17.48			#		
Turbidity	NTU	06/07/2016	N001	13 -	8.13			#		
Uranium	mg/L	06/07/2016	0001	13 -	0.95		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0455 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/23/2016	0001	46 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/23/2016	N001	46 -	173			#		
pH	s.u.	06/23/2016	N001	46 -	7.39			#		
Specific Conductance	umhos/cm	06/23/2016	N001	46 -	27.69			#		
Temperature	C	06/23/2016	N001	46 -	19.38			#		
Turbidity	NTU	06/23/2016	N001	46 -	999	>		#		
Uranium	mg/L	06/23/2016	0001	46 -	0.0022		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0456 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/23/2016	0001	53 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/23/2016	N001	53 -	188			#		
pH	s.u.	06/23/2016	N001	53 -	7.27			#		
Specific Conductance	umhos/cm	06/23/2016	N001	53 -	8774			#		
Temperature	C	06/23/2016	N001	53 -	19.94			#		
Turbidity	NTU	06/23/2016	N001	53 -	999	>		#		
Uranium	mg/L	06/23/2016	0001	53 -	0.028		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0457 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	29 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	29 -	-157			#		
pH	s.u.	06/03/2016	N001	29 -	7.66			#		
Specific Conductance	umhos/cm	06/03/2016	N001	29 -	6233			#		
Temperature	C	06/03/2016	N001	29 -	17.31			#		
Turbidity	NTU	06/03/2016	N001	29 -	1.17			#		
Uranium	mg/L	06/03/2016	0001	29 -	0.0036		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: 0492 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/05/2016	0001	18 -	1.5		J	#	0.1	
Oxidation Reduction Potential	mV	07/05/2016	N001	18 -	-27			#		
pH	s.u.	07/05/2016	N001	18 -	7.28			#		
Specific Conductance	umhos/cm	07/05/2016	N001	18 -	1104			#		
Temperature	C	07/05/2016	N001	18 -	18.41			#		
Turbidity	NTU	07/05/2016	N001	18 -	3.75			#		
Uranium	mg/L	07/05/2016	0001	18 -	0.047		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: AMM-2 WELL East of pile along road.

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	48 -	570		J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	48 -	72			#		
pH	s.u.	06/03/2016	N001	48 -	7.56			#		
Specific Conductance	umhos/cm	06/03/2016	N001	48 -	23030			#		
Temperature	C	06/03/2016	N001	48 -	17.54			#		
Turbidity	NTU	06/03/2016	N001	48 -	6.04			#		
Uranium	mg/L	06/03/2016	0001	48 -	2		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: AMM-3 WELL Near SE corner of pile.

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/06/2016	0001	48 -	300		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2016	N001	48 -	-79			#		
pH	s.u.	06/06/2016	N001	48 -	6.95			#		
Specific Conductance	umhos/cm	06/06/2016	N001	48 -	19536			#		
Temperature	C	06/06/2016	N001	48 -	19.48			#		
Turbidity	NTU	06/06/2016	N001	48 -	54			#		
Uranium	mg/L	06/06/2016	0001	48 -	2.5		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: ATP-2-S WELL Piezometer; see boring ATP-2

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	25 -	490		J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	25 -	-195			#		
pH	s.u.	06/03/2016	N001	25 -	9.04			#		
Specific Conductance	umhos/cm	06/03/2016	N001	25 -	17627			#		
Temperature	C	06/03/2016	N001	25 -	24.35			#		
Turbidity	NTU	06/03/2016	N001	25 -	7.07			#		
Uranium	mg/L	06/03/2016	0001	25 -	0.0035		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: ATP-3 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Ammonia Total as N	mg/L	06/14/2016	0001	51	-	0.14	J	#		0.1	
Oxidation Reduction Potential	mV	06/14/2016	N001	51	-	-46		#			
pH	s.u.	06/14/2016	N001	51	-	7.31		#			
Specific Conductance	umhos/cm	06/14/2016	N001	51	-	2906		#			
Temperature	C	06/14/2016	N001	51	-	19.37		#			
Turbidity	NTU	06/14/2016	N001	51	-	1.62		#			
Uranium	mg/L	06/14/2016	0001	51	-	0.0025	J	#		0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: CR1 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
								Lab	Data	QA		
Ammonia Total as N	mg/L	06/30/2016	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/30/2016	N001	0	-	0	128		#			
pH	s.u.	06/30/2016	N001	0	-	0	7.81		#			
Specific Conductance	umhos/cm	06/30/2016	N001	0	-	0	593		#			
Temperature	C	06/30/2016	N001	0	-	0	12.23		#			
Turbidity	NTU	06/30/2016	N001	0	-	0	54.8		#			
Uranium	mg/L	06/30/2016	0001	0	-	0	0.002	J	#		0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: CR2 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/30/2016	0001	0 - 0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/30/2016	N001	0 - 0	136			#		
pH	s.u.	06/30/2016	N001	0 - 0	8.03			#		
Specific Conductance	umhos/cm	06/30/2016	N001	0 - 0	538			#		
Temperature	C	06/30/2016	N001	0 - 0	22.9			#		
Turbidity	NTU	06/30/2016	N001	0 - 0	97.2			#		
Uranium	mg/L	06/30/2016	0001	0 - 0	0.0024		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: CR3 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/05/2016	0001	0 - 0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	07/05/2016	N001	0 - 0	20.7			#		
pH	s.u.	07/05/2016	N001	0 - 0	7.81			#		
Specific Conductance	umhos/cm	07/05/2016	N001	0 - 0	691			#		
Temperature	C	07/05/2016	N001	0 - 0	22.32			#		
Turbidity	NTU	07/05/2016	N001	0 - 0	999	>		#		
Uranium	mg/L	07/05/2016	0001	0 - 0	0.0027		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: CR5 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/06/2016	0001	0 - 0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	07/06/2016	N001	0 - 0	106			#		
pH	s.u.	07/06/2016	N001	0 - 0	7.92			#		
Specific Conductance	umhos/cm	07/06/2016	N001	0 - 0	688			#		
Temperature	C	07/06/2016	N001	0 - 0	22.66			#		
Turbidity	NTU	07/06/2016	N001	0 - 0	999	>		#		
Uranium	mg/L	07/06/2016	0001	0 - 0	0.003		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: MW-3 WELL See borehole 8

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/06/2016	0001	44 -	490		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2016	N001	44 -	250			#		
pH	s.u.	06/06/2016	N001	44 -	6.92			#		
Specific Conductance	umhos/cm	06/06/2016	N001	44 -	30769			#		
Temperature	C	06/06/2016	N001	44 -	17.45			#		
Turbidity	NTU	06/06/2016	N001	44 -	3.02			#		
Uranium	mg/L	06/06/2016	0001	44 -	2.9		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: SMI-PZ2M2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/06/2016	0001	56 -	690		J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2016	N001	56 -	152			#		
pH	s.u.	06/06/2016	N001	56 -	6.67			#		
Specific Conductance	umhos/cm	06/06/2016	N001	56 -	74519			#		
Temperature	C	06/06/2016	N001	56 -	17.74			#		
Turbidity	NTU	06/06/2016	N001	56 -	2.36			#		
Uranium	mg/L	06/06/2016	0001	56 -	2.2		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: SMI-PZ3S WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/29/2016	0001	25 -	3.1		J	#	0.1	
Ammonia Total as N	mg/L	06/29/2016	0002	25 -	2.8		J	#	0.1	
Oxidation Reduction Potential	mV	06/29/2016	N001	25 -	197			#		
pH	s.u.	06/29/2016	N001	25 -	7.46			#		
Specific Conductance	umhos/cm	06/29/2016	N001	25 -	4530			#		
Temperature	C	06/29/2016	N001	25 -	18.39			#		
Turbidity	NTU	06/29/2016	N001	25 -	3.05			#		
Uranium	mg/L	06/29/2016	0001	25 -	0.99		J	#	0.00012	
Uranium	mg/L	06/29/2016	0002	25 -	0.95		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: TP-01 WELL Date, GR_Elev, Boring_Depth frm SMIDoc#2 (ORNL 1/9/98)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	22 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	22 -	-210			#		
pH	s.u.	06/03/2016	N001	22 -	6.99			#		
Specific Conductance	umhos/cm	06/03/2016	N001	22 -	7397			#		
Temperature	C	06/03/2016	N001	22 -	15.5			#		
Turbidity	NTU	06/03/2016	N001	22 -	1.7			#		
Uranium	mg/L	06/03/2016	0001	22 -	0.055		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: TP-11 WELL Date, GR_Elev, Boring_Depth frm SMIDoc#2 (ORNL 1/9/98);PWC_Moab.mdb chemistry data in both HLA Surface_Water and HLA Groundwater tables

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	30 -	0.74		J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	30 -	-210			#		
pH	s.u.	06/03/2016	N001	30 -	6.92			#		
Specific Conductance	umhos/cm	06/03/2016	N001	30 -	20128			#		
Temperature	C	06/03/2016	N001	30 -	16.36			#		
Turbidity	NTU	06/03/2016	N001	30 -	7.71			#		
Uranium	mg/L	06/03/2016	0001	30 -	0.001		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: TP-17 WELL Date, GR_Elev, Boring_Depth frm SMIDoc#2 (ORNL 1/9/98)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	07/05/2016	0001	28 -	2		J	#	0.1	
Oxidation Reduction Potential	mV	07/05/2016	N001	28 -	-119			#		
pH	s.u.	07/05/2016	N001	28 -	7.06			#		
Specific Conductance	umhos/cm	07/05/2016	N001	28 -	74909			#		
Temperature	C	07/05/2016	N001	28 -	15.29			#		
Turbidity	NTU	07/05/2016	N001	28 -	33.4			#		
Uranium	mg/L	07/05/2016	0001	28 -	0.012		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: TP-20 WELL Date, GR_Elev, Boring_Depth frm SMIDoc#2 (ORNL 1/9/98)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/08/2016	0001	32 -	3.7		J	#	0.1	
Oxidation Reduction Potential	mV	06/08/2016	N001	32 -	-152			#		
pH	s.u.	06/08/2016	N001	32 -	7.19			#		
Specific Conductance	umhos/cm	06/08/2016	N001	32 -	145392			#		
Temperature	C	06/08/2016	N001	32 -	19.31			#		
Turbidity	NTU	06/08/2016	N001	32 -	2.4			#		
Uranium	mg/L	06/08/2016	0001	32 -	0.0016		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: TP-22 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/06/2016	0001	17 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/06/2016	N001	17 -	58			#		
pH	s.u.	06/06/2016	N001	17 -	6.7			#		
Specific Conductance	umhos/cm	06/06/2016	N001	17 -	38393			#		
Temperature	C	06/06/2016	N001	17 -	16.97			#		
Turbidity	NTU	06/06/2016	N001	17 -	21.9			#		
Uranium	mg/L	06/06/2016	0001	17 -	0.41		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: TP-23 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/07/2016	0001	25 -	200		J	#	2.5	
Oxidation Reduction Potential	mV	06/07/2016	N001	25 -	-23			#		
pH	s.u.	06/07/2016	N001	25 -	6.81			#		
Specific Conductance	umhos/cm	06/07/2016	N001	25 -	62272			#		
Temperature	C	06/07/2016	N001	25 -	19.5			#		
Turbidity	NTU	06/07/2016	N001	25 -	9.79			#		
Uranium	mg/L	06/07/2016	0001	25 -	2.7		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-17 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/29/2016	0001	14.5 -	320		J	#	10	
Oxidation Reduction Potential	mV	06/29/2016	N001	14.5 -	228			#		
pH	s.u.	06/29/2016	N001	14.5 -	6.71			#		
Specific Conductance	umhos/cm	06/29/2016	N001	14.5 -	10673			#		
Temperature	C	06/29/2016	N001	14.5 -	18.07			#		
Turbidity	NTU	06/29/2016	N001	14.5 -	7.27			#		
Uranium	mg/L	06/29/2016	0001	14.5 -	1.3		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-18 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/29/2016	0001	13 -	170		J	#	10	
Oxidation Reduction Potential	mV	06/29/2016	N001	13 -	226			#		
pH	s.u.	06/29/2016	N001	13 -	6.67			#		
Specific Conductance	umhos/cm	06/29/2016	N001	13 -	13906			#		
Temperature	C	06/29/2016	N001	13 -	18.13			#		
Turbidity	NTU	06/29/2016	N001	13 -	7.68			#		
Uranium	mg/L	06/29/2016	0001	13 -	2		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-20 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/29/2016	0001	17 -	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	06/29/2016	N001	17 -	179			#		
pH	s.u.	06/29/2016	N001	17 -	6.97			#		
Specific Conductance	umhos/cm	06/29/2016	N001	17 -	5519			#		
Temperature	C	06/29/2016	N001	17 -	20.74			#		
Turbidity	NTU	06/29/2016	N001	17 -	25			#		
Uranium	mg/L	06/29/2016	0001	17 -	0.063		J	#	0.000012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-21 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/29/2016	0001	25 -	2.6		J	#	0.1	
Oxidation Reduction Potential	mV	06/29/2016	N001	25 -	1.9			#		
pH	s.u.	06/29/2016	N001	25 -	7.04			#		
Specific Conductance	umhos/cm	06/29/2016	N001	25 -	3882			#		
Temperature	C	06/29/2016	N001	25 -	19.33			#		
Turbidity	NTU	06/29/2016	N001	25 -	7.73			#		
Uranium	mg/L	06/29/2016	0001	25 -	6.2		J	#	0.00012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-22 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/03/2016	0001	9 -	7.1		J	#	0.1	
Oxidation Reduction Potential	mV	06/03/2016	N001	9 -	-150			#		
pH	s.u.	06/03/2016	N001	9 -	7.87			#		
Specific Conductance	umhos/cm	06/03/2016	N001	9 -	3916			#		
Temperature	C	06/03/2016	N001	9 -	16.77			#		
Turbidity	NTU	06/03/2016	N001	9 -	3.5			#		
Uranium	mg/L	06/03/2016	0001	9 -	2.4		J	#	0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-23 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
						Lab	Data	QA		
Ammonia Total as N	mg/L	06/30/2016	0001	26 -	2.4		J	#	0.1	
Oxidation Reduction Potential	mV	06/30/2016	N001	26 -	187			#		
pH	s.u.	06/30/2016	N001	26 -	7.31			#		
Specific Conductance	umhos/cm	06/30/2016	N001	26 -	3509			#		
Temperature	C	06/30/2016	N001	26 -	22.9			#		
Turbidity	NTU	06/30/2016	N001	26 -	101			#		
Uranium	mg/L	06/30/2016	0001	26 -	0.49		J	#	0.000012	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)

Water Quality Data (continued)

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: UPD-24 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Ammonia Total as N	mg/L	06/29/2016	0001	27	-	0.8	J	#		0.1	
Oxidation Reduction Potential	mV	06/29/2016	N001	27	-	198		#			
pH	s.u.	06/29/2016	N001	27	-	7.14		#			
Specific Conductance	umhos/cm	06/29/2016	N001	27	-	4283		#			
Temperature	C	06/29/2016	N001	27	-	18.24		#			
Turbidity	NTU	06/29/2016	N001	27	-	2.23		#			
Uranium	mg/L	06/29/2016	0001	27	-	3.6	J	#		0.00012	

General Water Quality Data by Location (USEE105) FOR SITE MOA01, Moab Site

REPORT DATE: 9/5/2016

Location: Z SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
								Lab	Data	QA		
Ammonia Total as N	mg/L	07/06/2016	0001	0	-	0	0.1	U	J	#	0.1	
Oxidation Reduction Potential	mV	07/06/2016	N001	0	-	0	110		#			
pH	s.u.	07/06/2016	N001	0	-	0	8.02		#			
Specific Conductance	umhos/cm	07/06/2016	N001	0	-	0	686		#			
Temperature	C	07/06/2016	N001	0	-	0	23.65		#			
Turbidity	NTU	07/06/2016	N001	0	-	0	999	>	#			
Uranium	mg/L	07/06/2016	0001	0	-	0	0.0063	J	#		0.000012	

BLS = below land surface; umhos/cm = micromhos per centimeter; mV = millivolt; NTU = nephelometric turbidity unit; SL = surface location; S.U. = standard unit; TS = treatment system; WL = well

Appendix E. June/July 2016 Site-wide Sampling Event (*continued*)

Water Quality Data (*continued*)

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- L Less than 3 bore volumes purged prior to sampling.
- U Parameter analyzed for but was not detected.
- G Possible grout contamination, pH > 9. J Estimated value.
- Q Qualitative result due to sampling technique.
- R Unusable result.
- X Location is undefined.

QA QUALIFIER:

- # Validated according to quality assurance guidelines.

**Appendix E. June/July 2016 Site-wide Sampling Event (continued)
Water Level Data**

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 9/15/2016						
Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
403	O	3968.95	6/8/2016	9.51	3959.44	
404	O	3968.3	6/8/2016	9.4	3958.9	
410	O	3981.05	6/28/2016	22.67	3958.38	
411	O	3962.43	6/28/2016	6.25	3956.18	
412	O	3962.48	7/7/2016	5.31	3957.17	
413	O	3963.19	6/3/2016	5.59	3957.6	
439	O	4055.27	6/28/2016	91.22	3964.05	
440	O	4070.71	6/28/2016	110.4	3960.31	
441	O	4008.77	6/14/2016	48.46	3960.31	
444	O	3970.99	6/3/2016	12.87	3958.12	
453	O	4031.29	6/28/2016	73.13	3958.16	
454	O	3966.53	6/7/2016	10.2	3956.33	
455	B	3990.2	6/23/2016	30.67	3959.53	
456	B	3990.46	6/23/2016	31.98	3958.48	
457	O	3971.3	6/3/2016	13.45	3957.85	
492	O	3967.56	7/5/2016	12.04	3955.52	
AMM-2	O	3964.09	6/3/2016	6.92	3957.17	
AMM-3	O	3962.9	6/6/2016	5.17	3957.73	
ATP-2-S	O	3962.17	6/3/2016	13.02	3949.15	
ATP-3	B	3998.29	6/14/2016	38.08	3960.21	
MW-3	O	3965.98	6/6/2016	8.35	3957.63	
SMI-PZ2M2	O	3967.18	6/6/2016	10.35	3956.83	
SMI-PZ3S	O	3975.03	6/29/2016	16.69	3958.34	
TP-11	O	3967.51	6/3/2016	9.24	3958.27	
TP-17	O	3963.69	7/5/2016	8.54	3955.15	
TP-20	O	3967.55	6/8/2016	11.93	3955.62	
TP-22	O	3966.51	6/6/2016	10.74	3955.77	
TP-23	O	3962.6	6/7/2016	5.89	3956.71	

Appendix E. June/July 2016 Site-wide Sampling Event (continued)
Water Level Data (continued)

STATIC WATER LEVELS (USEE700) FOR SITE MOA01, Moab Site						
REPORT DATE: 9/15/2016						
Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date Time	Depth From Top of Casing (Ft)	Water Elevation (MSL)	Water Level Flag
UPD-17	O	3967.44	6/29/2016	10.34	3957.1	
UPD-18	O	3969	6/29/2016	10.33	3958.67	
UPD-20	O	3978.73	6/29/2016	20.01	3958.72	
UPD-21	O	3981.45	6/29/2016	22.9	3958.55	
UPD-22	O	3966.2	6/3/2016	8.38	3957.82	
UPD-23	O	3982.38	6/30/2016	24.03	3958.35	
UPD-24	O	3977.1	6/29/2016	18.69	3958.41	

Flow Codes: B = background; C = cross gradient; D = downgradient; MSL = mean sea level O = on site; U = upgradient, Water Level Flags: D = dry

Appendix E. June/July 2016 Site-wide Sampling Event (continued)
Trip Report



Date: September 1, 2016
To: Ken Pill
From: James Ritchey
Subject: June/July 2016 Site Wide Sampling Event
Site: Moab – Site-wide Sampling Event – June/July 2016
Date of Sampling Event: June 03 – July 07, 2016
Team Members: E. Moran, K. Pill, and J. Ritchey
RIN Number Assigned: All samples were assigned to RIN 1606086.
Sample Shipment: Samples coolers were shipped overnight UPS to ALS Laboratory from Moab, Utah, on June 15, and on July 7 of 2015 (Tracking numbers 1Z5W1Y510192158076 and 1Z5W1Y510196491976).

Number of Locations Sampled: The purpose of the Site Wide Sampling Event is to update contaminant plume maps. A total of 44 locations (eight surface samples and 36 monitoring wells) were sampled during this event. Including three duplicates and one equipment blank, a total of 48 samples were collected during the June 2016 sampling event.

Locations Not Sampled/Reason: None.

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Associated matrix
2000	0441	Duplicate from 53 ft bgs	Ground Water
2001	SMI-PZ3S	Duplicate from 25 ft bgs	Ground Water
2002	NA	Equipment Blank	DI Water
2003	0412	Duplicate from 9.5 ft bgs	Ground Water

Location Specific Information: All of the observation wells were sampled using a peristaltic pump and dedicated tubing unless otherwise noted. The surface water samples were collected with dedicated surface water tubing that was decontaminated with Alconox® and de-ionized water between locations. The table below provides additional information:

**Appendix E. June/July 2016 Site-wide Sampling Event (continued)
Trip Report (continued)**

Location	Date	Sample Depth (ft bgs)	Comments
0201	07/06/2016	–	
0218	06/30/2016	–	
0226	07/05/2016	–	Turbid water, can't determine depth, moderate flow, just of bank.
0403	06/08/2016	18	
0404	06/08/2016	18	
0410	06/28/2016	23.5	
0411	06/28/2016	8	*Dewatered at 0.5 L.
0412	07/07/2016	9.5	Duplicate 2003
0413	06/03/2016	10.5	
0439	06/28/2016	118	Bladder pump.
0440	06/28/2016	117	Bladder pump.
0441	06/14/2016	53	Bladder pump. Duplicate 2000
0444	06/03/2016	116	
0453	06/28/2016	80	
0454	06/07/2016	13	Bladder pump. *Water level not obtainable while pumping
0455	06/23/2016	46	Inertia pump
0456	06/23/2016	53	Inertia Pump
0457	06/03/2016	29	
0492	07/05/2016	18	
AMM-2	06/03/2016	48	
AMM-3	06/06/2016	48	
ATP-2-S	06/03/2016	25	
ATP-3	06/14/2016	51	Bladder pump.
CR1	06/30/2016	–	
CR2	06/30/2016	–	
CR3	07/05/2016	–	Little flow, 3ft from bank, turbid water.
CR5	07/06/2016	–	
MW-3	06/06/2016	44	
SMI-PZ2M2	06/06/2016	56	
SMI-PZ3S	06/29/2016	25	Duplicate 2001
TP-01	06/03/2016	22	Water level not obtainable.
TP-11	06/03/2016	30	
TP-17	07/05/2016	28	Water is black.
TP-20	06/08/2016	32	
TP-22	06/06/2016	17	
TP-23	06/07/2016	25	
UPD-17	06/29/2016	14.5	
UPD-18	06/29/2016	13	
UPD-20	06/29/2016	17	
UPD-21	06/29/2016	25	
UPD-22	06/03/2016	9	
UPD-23	06/30/2016	26	Dewatered at 0.25 L.
UPD-24	06/29/2016	27	
Z	07/06/2016	–	

Notes: ft bgs = feet below ground surface

Water Level Measurements: Water level data are provided in the table below. These data represent depth to water (ft btoc) measurements.

**Appendix E. June/July 2016 Site-wide Sampling Event (continued)
Trip Report (continued)**

Well No.	Date	Depth to Water (ft btoc)
0201	07/06/2016	NA
0218	06/30/2016	NA
0226	07/05/2016	NA
0403	06/08/2016	9.51
0404	06/08/2016	9.40
0410	06/28/2016	22.67
0411	06/28/2016	6.25
0412	07/07/2016	5.31
0413	06/03/2016	5.59
0439	06/28/2016	91.22
0440	06/28/2016	110.40
0441	06/14/2016	48.46
0444	06/03/2016	12.87
0453	06/28/2016	73.13
0454	06/07/2016	10.20
0455	06/23/2016	30.67
0456	06/23/2016	31.98
0457	06/03/2016	13.45
0492	07/05/2016	12.04
AMM-2	06/03/2016	6.92
AMM-3	06/06/2016	5.17
ATP-2-S	06/03/2016	13.02
ATP-3	06/14/2016	38.08
CR1	06/30/2016	NA
CR2	06/30/2016	NA
CR3	07/05/2016	NA
CR5	07/06/2016	NA
MW-3	06/06/2016	8.35
SMI-PZ2M2	06/06/2016	10.35
SMI-PZ3S	06/29/2016	16.69
TP-01	06/03/2016	NA
TP-11	06/03/2016	9.24
TP-17	07/05/2016	8.54
TP-20	06/08/2016	11.93
TP-22	06/06/2016	10.74
TP-23	06/07/2016	5.89
UPD-17	06/29/2016	10.34
UPD-18	06/29/2016	10.33
UPD-20	06/29/2016	20.01
UPD-21	06/29/2016	22.90
UPD-22	06/03/2016	8.38
UPD-23	06/30/2016	24.03
UPD-24	06/29/2016	18.69
Z	07/06/2016	NA

Well Inspection Summary: A well inspection was not conducted.

Equipment: None.

Regulatory: None.

Site Issues: According to the USGS Cisco Gaging Station (Station No. 09180500), the mean daily Colorado River flow during this sampling event is provided below:

**Appendix E. June/July 2016 Site-wide Sampling Event (continued)
Trip Report (continued)**

Date	Daily Mean Flow (cfs)
6/3/2016	15,400
6/4/2016	17,200
6/5/2016	19,400
6/6/2016	22,600
6/7/2016	24,500
6/8/2016	24,400
6/9/2016	24,700
6/10/2016	23,600
6/11/2016	24,000
6/12/2016	24,100
6/13/2016	23,300
6/14/2016	22,300
6/15/2016	20,500
6/16/2016	18,600
6/17/2016	17,800
6/18/2016	16,900
6/19/2016	16,300
6/20/2016	15,800
6/21/2016	15,600
6/22/2016	16,000
6/23/2016	15,700
6/24/2016	15,500
6/25/2016	15,400
6/26/2016	14,400
6/27/2016	13,400
6/28/2016	12,300
6/29/2016	11,000
6/30/2016	9,900
7/1/2016	9,850
7/2/2016	10,400
7/3/2016	11,100
7/4/2016	11,300
7/5/2016	10,800
7/6/2016	9,650
7/7/2016	8,860

Corrective Action Required/Taken: None.